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ABSTRACT

Eight papers are presented from the 1994 CAUSE conference track on customer-centered partnering within and among higher education institutions in regard to information resources and technology. The papers include: (1) "Customer-Centered Collaboration: Libraries and IT," which focuses on the use of teams, total quality management, and business process reengineering (Geri Bunker and Barbara Horgan); (2) "Making Order Out of Chaos with a Computerized Lottery," which discusses the use of a class scheduling lottery at the Massachusetts Institute of Technology (Steven Anders Oakland); (3) "Customers as Partners in the Information Technology Planning Process," which describes the development of the Information Technology Planning Project at the University of Minnesota (Linda Jorn and others); (4) "Distance Education: What's Up," which focuses on new trends in distance education (Gene T. Sherron); (5) "Reengineering Administrative Partnerships," which examines the reengineering of student services at the University of Delaware (Susan Cover and Joseph DiMartile); (6) "The Consultancy: A Team Approach to Developing Partnerships with IT Customers," (Jan A. Baltzer and Pat Honzay); (7) "Reengineering for the 13th Generation" (Louise Lonabocker and John Springfield); and (8) "Growing the Customer--IS Partnership in System Development" (Susan R. Griffith and others). (Some papers contain references.) (MDM)

New Opportunities for Partnering

CAUSE 94

TRACK II
FOCUS ON THE CUSTOMER

Coordinator: John D. Busby

Proceedings of the 1994 CAUSE Annual Conference

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CUSTOMER-CENTERED COLLABORATION: LIBRARIES AND IT

Geri Bunker
Head, Library Systems Operations
University of Washington Libraries

Barbara Horgan
Associate Vice President for Information Services
Seattle University

In the Fall '94 *CAUSE/EFFECT*, which focuses on library and Information Technology relationships, collaboration is variously defined as "working together toward shared group goals" [1] and "the process of shared creation." [2] In both of these senses, collaboration between librarians and information technologists is seen as valuable, even necessary. The need for these two groups to collaborate arises from convergence of their missions, user demands for coordinated services, competition for resources, and advances in electronic storage, retrieval and sharing of information. Moreover, the pace of technology requires rapid yet flexible responses, not protracted haggling over territories, roles and responsibilities. What's needed are strategies to accelerate the collaborative process; strategies adaptable enough to deal with change yet creative enough to foster both internal and external cooperative efforts.

Furthermore, these strategies should be seen as a means to the end of satisfying customer needs for integrated information services. Moving from separateness to synergy can be facilitated by the selective use of certain popular management methods. These techniques include the use of teams, changes in reporting structures, integration, cross-pollination, management dictates, as well as elements of some popular external-stimulus approaches such as Total Quality Management (TQM) and Business Process Re-engineering (BPR). The success of these strategies in the collaborative setting depends upon library and computing leaders' willingness and ability to embrace a common vision, articulate a clear direction, share risks and accept new responsibilities.

Rosabeth Kanter recently described eight conditions for successful collaboration between organizations. [3] She argues persuasively that truly advantageous partnerships require real commitment to the relationshipsthemselves, and not mere attention to the benefits of any one specific deal. Like good marriages, relationships between libraries and computing organizations need to meet certain criteria for ensured success. Among these, Kanter lists:

- individual excellence of the each of the partners independently,
- long-term goals of each organization which include the relationship itself as an important strategy
- the partners' complementary skills and assets
- investment of resources
- open flow of information
- integration developed through working linkages and connections
- the relationship's formal status within the institution
- integrity as displayed by mutual respect between the partners.

STRATEGIES—TEAMS, TQM AND BPR

All these methods have promise for dealing effectively with the problems facing our institutions today: shrinking budgets, retraining the workforce, demands for accountability and lack of coordinated services.

Although many schools and businesses are adopting these strategies as panaceas, there are significant difficulties which can sabotage their wholesale introduction and success.

First, these solutions are very resource-intensive—requiring additional staff, money for training and consultants—at a time when most institutions are strapped for resources.

Second, they take a long time to achieve results when the crisis in higher education demands rapid response.

Third, maintaining current operations and services while undertaking organizational change of the magnitude suggested by TQM and BPR is very difficult.

Fourth, using consultants to introduce these new programs may become an addiction. Also, consultants often present packaged training plans not suited to your organization or its culture. Finally, much of the literature and research focuses on business models of the adaptation of these techniques. There are significantly different variables to consider in an academic setting. Rather than adopting any one approach entirely, librarians and IT professionals may find portions of the techniques promote improved customer service, synergy, adaptation to change, and re-organization of outmoded structures.

Teams

In all three strategies, the use of teams is seen as a positive force for worker empowerment, customer satisfaction, coping with change and the breaking down of organizational barriers. According to Jon Katzenbach a team may be defined as "... a small group (less than 20 persons) with complementary skills, committed to a common purpose and set of specific performance goals. Members are committed to working together to achieve the team's purpose and hold each other jointly and fully accountable for the team's results." [4]

Using teams to promote synergy will only be successful under certain conditions. Across and within the organizations, teams only thrive where there is:

- excellent verbal and written communication
- a high level of interpersonal trust
- authority residing in the team for decision-making.

What is typically missing, both within an organizational unit and across the organization generally, is a clearly articulated and commonly embraced understanding of:

- the mission of the parent and constituent organizations
- team purposes and objectives
- service level agreements
- reward structures for team participation [5]

In addition, a teams approach requires significant commitment of resources by the parent organizations. To embark half- heartedly upon teams-building, i.e., without proper allocation of resources for training and planning, is to court disaster. Performance is doubly hampered when teams are allowed to stagnate or are not supported enthusiastically by upper management. Teams can be successful only if properly planned and adequately supported.

TQM

Another popular management strategy for improving service operations is Total Quality Management. While TQM evolved with Edward Deming in the 1950s, it was not until the mid to late 80's that it became popular in this country. The Malcolm Baldrige National Quality Award [6] was established in 1987 as a private/public partnership to encourage quality in American companies. Definitions of quality vary from Crosby's brief "conformance to requirements" [7] to Deming's more detailed 14 points. [8]

Most quality approaches, though, have the following elements: customer focus, empowerment of all employees, strong emphases on training, teams, benchmarking and continuous process improvement. The strengths of TQM are that it:

- focuses on the customer

- can lower costs while providing better, more timely service
- brings strength and depth to organizations by empowering employees
- provides a structured method for improving processes and measuring results

The danger in this strategy is that the process can become an end in itself, rather than a means to improve customer satisfaction and business processes. An excessive proliferation of teams and overemphasis on training, without addressing customer needs and institutional goals, can sometimes result.

Both teams and TQM are best used when there is a specific customer need to be addressed, explicit requirements and measurable gains. A hypothetical example may illustrate: a user survey shows that customers need more help with Internet navigation. A team comprising staff from several levels of both the IT and the Library organization is formed to design, implement and evaluate a program of on-line consulting within a specified timeframe and with frequent measurement of user satisfaction and service levels.

Business Process Re-Engineering (BPR)

The most recent management trend is business process re- engineering. This strategy involves a fundamental rethinking and radical redesign of business process to achieve dramatic improvements in critical contemporary measures of performance: cost, quality, service and speed. BPR is broader in scope and takes longer to implement than most Quality programs. It is far more revolutionary, requiring reinventing, making sweeping changes in management and organizational structure. In a reengineered process, the work units change from functional units to process-oriented teams. Jobs change from simple tasks to multidimensional work, so that workers achieve a greater sense of completion, closure and accomplishment. [9]

In BPR the typical functional division in computing is discarded in favor of process-oriented team. At the University of Idaho, hierarchical and functional structures were disbanded to create a flat organization, with no staff member reporting to anyone but the top management team. This reorganization facilitated equal and open team recruitment. Now employees see themselves as team members rather than as aligned with a particular functional area.

Some useful attributes of BPR are:

- it is customer driven
- it facilitates worker empowerment, with authority for their responsibility
- it forces a wholistic rather than a piecemeal examination of processes

Problems occur when organizations adopt programs such as BPR without regard to local conditions and values. Unlike TQM, BPR is radical—it requires, by definition, the changing of a process rather than its improvement. It should only be embarked upon if there is commitment from the top to pursuing a radical solution; resources to facilitate that change— consultant support, money and time for training—and recogniton of how BPR will impact operations.

Common themes running through all three strategies—teams, BPR and TQM—include: the importance of focusing on the customer, the need for management support and change as a constant. As service organizations, libraries and IT have a primary mission of assessing and satisfying the needs of their customers. Although this has always been true, the new management strategies emphasize refocusing on what it means to be "customer centered".

FOCUS ON SERVICE TO THE CUSTOMER

One of the fundamental requirements for customer service in a collaborative environment is that the partners have the same definition of the client base of customers. At the very least, they must explicitly agree on various categories and on the prioritization of those customer needs. The University needs to agree, and have articulated a vision to support that customer base. For example, in a large, public research university, the customers include the faculty, staff and students; they probably also include the taxpaying

citizens of the state. The needs of these constituent groups may sometimes conflict. Even if they are in harmony, it is important to agree upon prioritization.

Focusing on the customer means measuring success by customer- defined criteria. For example, successful computing for a research physicist may mean faster CPU cycles and broader network bandwidth while her secretary may define good service as a speedy answer to his help desk question. Therefore, it is important to understand and focus on what the customer considers good service and to prioritize the level of service in accordance with the mission of the overall organization.

When librarians and IT professionals define joint projects, it is helpful to apply what the University of Washington Libraries calls a "customer-centered filter". Additions or deletions to services and products must be decided according to what the primary customer base needs most. This can help settle disputes between partners, help to reach consensus and negotiate to "yes" on the myriad of good ideas often presented.

One of the difficult issues libraries and IT organizations need to focus on is the need for a single point of contact for the end user of the Internet. With the goal of improving faculty use of the Internet at Seattle University, a librarian, computing user services staff and a faculty member collaborate to offer a course on using the Internet for research. The course is taught and designed by the faculty member, with library assistance in identifying the best resources; advertising, scheduling and coordinating is done through the information technology office.

Understanding and improving the processes begins and ends with customer-centered requirements. [10] Constant evaluation of services both separately and jointly involves measuring baseline service levels and improvements by conducting qualitative and quantitative customer surveys. At Harvard University's Office of Information Technology, the service improvement process begins with identifying the customer output requirements and the process to improve. The next steps are to analyze, measure, improve and evaluate the service. Through the entire process, the customer's perspective must set the course.

MANAGEMENT SUPPORT AND STRATEGIES

One key to success with a collaborative approach is top management's support for the strategy. Not only must the leaders believe in the collaborative effort, they must articulate that belief in terms of a shared mission, vision and goals—in meetings, jointly published statements and other visible indicators.

Statements of collaboration must be backed by resource allocation. Allowing mid-level managers to control their budgets is a clear indicator of high-level support. Risk-taking and innovation should be promoted and supported through reward and recognition. Another consideration in resource allocation is the development of service level agreements—who will do what, provide what, in what time frame, with what response time. Anita Lowry's article on "The Information Arcade at the University of Iowa," gives a recipe for success which includes "Documented agreements regarding the respective responsibilities for and contributions to the project, with specific commitments in terms of personnel, funds, and other resources." [11]

At the University of Washington, the University Advisory Committee on Academic Technology, beginning in 1988, recommended the building of strategic relationships between Computing & Communications and the University Libraries. [12] They also recommended increased use of centrally maintained hardware and advocated 100% building connectivity by 1997 using tcp/ip protocols. Many projects have come to completion through the joint work of the Computing & Communications and Libraries organizations. In all cases, resources were allocated within all participating groups, and University funding was made available as well.

By promoting and rewarding cross-organizational teams, mid- level managers can enhance synergy. Providing adequate resources involves training in such team skills as facilitating, brainstorming, achieving consensus, problem solving and conflict resolution. Team members' rewards should include linking team performance with individual

employee evaluations. Team training requires providing sufficient staff backup so that team members can suspend regular duties in order to train for the team's work.

With the customers' satisfaction as the overarching goal, it becomes important to focus on process and service rather than organizational structures and functions. Individual skills, not sterotypes and hierarchy are the considerations in building a successful team. For example, the librarian with technical skills and the programmer with documentation skills may be the most appropriate team members for developing manuals on Internet navigation.

Managers can build flexibility and responsiveness into teams by encouraging interlocking memberships and by assuring authority to carry out decisions made. At Seattle University, the Associate VP for IS built a CWIS team to include not only a programmer, Help Desk Manager and the public services librarian, but also the University publications officer, the Business School computing coordinator and a representative from the largest end-user community, the students. Team members are given a budget to accomplish tasks that require additional resources.

CHANGE AS A CONSTANT

From top management on down, openness to changing traditional patterns and structures must be encouraged and seen as a positive and inevitable force. Change should be expected and even anticipated as a source of opportunities. Library and computing managers should—both separately and jointly— review evolving roles in their organizations. Rather than competing for niches, it may be advantageous to adopt an inclusive attitude which views library and information technology positions as all part of the same "job family". [13]

Managers create the environment and provide resources for change; staff identify opportunities for improvement and implement change. Listening to customers and to each other is an important part of this process. Regular time together— in joint meetings, shared working spaces, collaborative projects—encourages communication and questioning of current practices. Used appropriately, job sharing spreads expertise and responsibility for operational functions across units and organizations.

Changes made for change sake, however, should be avoided, especially if they are technology, not customer, driven. For example, user interfaces to campus wide information systems should not be capriciously modified; instead, enhancements can be accumulated, allowing time between releases for the system's users to catch up.

Change is also an important component of continuous quality improvement. Once a process is identified for improvement, the steps in the process include planning for change, trying it out, checking to be sure results are what was expected, making adjustments, implementing the change, and making it part of the systems and processes being managed. Once a successful change is implemented, its productive components can be identified for use in other situations. [14] This notion of re-using best practices is what is behind the concept of benchmarking.

BENCHMARKING

Determining where and when change is appropriate is easier when regular assessment of processes and customer satisfaction is being performed. Benchmarking, an important component of both BPR and TQM approaches, is one such assessment tool. It can connote constant statistical monitoring of processes; but more broadly defined, benchmarking means measuring your own organization's performance in qualitative or quantitative ways against other similar organizations which are models of successful or efficient operation. Both types of benchmarking can be used to improve customer service. In addition, if librarians and information technologists observe and implement each others' best practices, collaboration increases and products and services shared between organizations improve. The first step in benchmarking is to determine what services to measure; these should include processes which are important to your customers. The next

step is planning the benchmarking project and choosing a team leader. Before studying others, it is important to understand the factors that affect your own performance. The next step is studying others, searching out leaders who have demonstrated successful collaboration and improvement of services, preparing questions, and performing the study. Conference presentations and conversations as well as professional literature can help identify successful models to study. Learning from the data collected about others is the fifth step. The final step is determining how to use the results in the organization. [15]

Librarians and information technologists can share best practices/successes with one another, particularly in the user services area. At Seattle University, the library liaison program, which pairs librarians with departments and colleges for collection planning and development, served as a model for a "customer service representative" in IT. Computing staff designated as service reps are paired with a liaison in each college or administrative area for communication about technical needs and changes as well as for planning new information technology services and training programs.

OUTSOURCING TO EXPAND RESOURCES: PROS AND CONS

Another practice which has been useful in the business world and adopted by some libraries and computing organizations is outsourcing; that is, using external resources to offer services that have traditionally been provided internally. Outsourcing can provide resources and expertise that would be difficult if not impossible to provide in-house. Small computing organizations, for instance, often cannot afford the staffing resources required to plan and implement a campus network and must outsource wiring and even installation of network cards and software to contractors for a limited period of time. Outsourcing has its dangers, however. Top financial managers can be persuaded by vendors that it is a panacea, sometimes without careful consideration of the potential consequences. When not used selectively, outsourcing can lead to dependency upon external resources. When goals, deliverables and timelines are not clearly established by the contractingorganization, a lack of control can result. Just as with teams, well developed service level agreements between the parties are critical to its success but not easily developed or monitored.

Outsourcing training to introduce new concepts and techniques—including Teams, TQM and BPR—is often more effective than using internal resources. Trainers who have expertise in these techniques are brought in to train staff, train the trainers, and/or recommend a course of action to improve service delivery and collaboration. Many consultants, however, recommend "packaged" approaches not customized to your environment. If the techniques do not suit the local culture, there is little chance they will be adopted.

To cut costs of employing outside resources, librarians and information technologists should consider sharing them. Having these two professional groups attending the same classes also promotes communication and synergy. Sharing in- house trainers is another strategy for facilitating cooperation and saving money.

NEGOTIATE RESOURCES FOR SYNERGISTIC RESULTS

Such leveraging of resources can be done internally as well as with external consultants. In the following two examples, libraries and IT organizations achieved synergistic effects through collaboration in situations where resources were scarce.

University of Washington's experience

Leveraging resources can be accomplished with cross- organizational teams, which share staff, pool dollars and provide cross-training opportunities. In 1992 the University of Washington undertook to replace its automated library management system and to build a campus-wide information system. The campus was (and is) dedicated to open networking, a uniform interface to information resources, and a collaborative approach to campus-wide computing.

In accord with the University Advisory Committee on Academic Technology's directive, [16] the Libraries and Computing & Communications (C&C) have jointly built an information system for the campus which includes administrative information, computing technology policies, procedures and events, the libraries' online catalog, locally mounted abstracting and indexing databases, and Internet searching tools.

They pooled funding and secured a matching amount from the University in order to replace the existing proprietary (Geac) library management system (ILS) with one which could be snugly integrated with the campus tcp/ip network. C&C's Information Systems and the University Libraries jointly negotiated a contract with Innovative Interfaces, Inc. for their unix-based ILS. This was all part of the manifestation of a well-articulated vision for networking, workstation deployment and information technology across the campus. That vision is an essential element of collaborative change in any complex environment.

Public access to information and bibliographic data had been provided by the joint development of both a graphical and a character-based user interface (Willow and UWIN/Wilco). The Health Sciences Library and Information Center, in conjunction with Computing & Communications' Information Systems (IS), had earlier developed the X11/Motif based GUI (Willow, a general purpose information retrieval tool for use with MEDLINE. With librarians and faculty guiding the functional design, and the IS programming staff using the most efficient development tools, the mix of expertise proved very successful. Willow functionality was then adapted for the lowest-common denominator interface—character-based vt100. [17]

Because the Innovative database is maintained in the libraries, using the Innovative "off the shelf" system, Librarians and programmers worked on small development teams, one of which produced a MARC format loader for our BRS Onsite system (which Willow and Wilco query). Librarians provided the MARC expertise, and helped the programmers to map appropriate tagged fields to BRS paragraph structures. Outsourcing was used again to preprocess the library catalog by a service provider. The Libraries now regularly sends its data out incrementally, to be "massaged" by authorities preprocessors.

In this way, a careful mix of outsourcing and local, joint development was used in order to meet the common goals in a timely fashion, and with the resources we were able to bring to bear. By Fall, 1994, most of the teams had disbanded, having achieved their charges. The new services were absorbed into the operational stream, and cross-divisional advisory groups were appointed to oversee the services.

Seattle University's experience

Another library development project, this at a much smaller institution, used collaborative teams, resource sharing, top management support, and flexible boundaries to achieve the goal of meeting customer needs for an automated catalog available anywhere on and off campus.

When a new Associate Vice President for Information Services arrived at Seattle University in the fall of 1991, funds had been set aside for a library project, but the Library Director did not have access to them. Because of her recent experience in implementing an automated library system and a campus-wide network elsewhere, the Associate VP was charged by the Provost to lead the automation project with the Library Director and was given funding for the project.

Examining the technology resources of the Library, she decided to ask the University Cabinet for additional funds to acquire microcomputers and to begin to network within the Library. Simultaneously, a campus-wide network project was being proposed, with future access to the library holdings from anywhere on and off campus as one of the primary benefits. The Cabinet request for additional funding was accepted, and library staff training in office automation and networking was initiated by IS.

The automation team was composed of equal numbers of IS and library professionals. Information Services contributed an under-utilized RISC machine to run the library system. They also agreed to manage hardware and network maintenance, to prepare

and monitor the overall project plan and to perform financial and technical analyses of alternatives. The Librarians developed evaluation tools and scenarios for examining functionality and setting priorities. A champagne toast ended the planning phase of the project.

Relationships, however, were sometimes strained. Librarians disliked the name "information services" being given to a computing organization and were suspicious that IS was trying to take them over. After the selection, an implementation team including IS focused on technical details, but another team, LISP (Library-IS Partnership), undertook the task of building bridges and identifying projects "beyond OPAC." The AVP served on the Search Committee for a new Library Director, who now chairs the group. Because of the monthly meetings of LISP, the Library became a key partner in developing SU's CWIS and the Library and IS now offer Internet courses jointly developed and taught.

Start Small

Clearly the projects just described are an accumulation of many small cooperative and collaborative efforts. To start, projects should be small and well defined. Efforts should address customer needs and use the special skills of each organization. Milestones in the pilot can be acknowledged and recognized as successes. Rewards should reflect appropriate levels of compensation and varying motivations. With a small success accomplished and recognized, larger collaborative projects can be initiated.

CONCLUSION

The theme of Library/Information Technology collaboration is a popular one, as evidenced by CAUSE's dedication of an entire issue to this subject. Numerous case studies document schools which have attempted collaborative efforts, benefitted from them, and described the lessons learned. Chances for successful collaborative projects, however, are increased if certain strategies are employed from the outset. Many of these techniques are already familiar as part of current management trends for using teams, promoting quality, and re-engineering the organization:

- focusing on customer needs first
- getting top management support
- developing and articulating joint mission statements and service agreements
- planning for change and continuous process improvement
- building flexibility into organizational structures
- benchmarking services and processes with peers
- outsourcing where needed to expand resources
- negotiating ways to achieve synergistic effects
- starting with small projects before moving to more ambitious collaborative efforts.

Footnotes:

1 Sara Kiesler, "Working Together Apart," *CAUSE/EFFECT,* Fall, 1994, p. 8.

2 Michael Schrage, *Shared Minds: The New Technologies of Collaboration*, (New York: Random House, 1990) p. 40.

3 Rosabeth Moss Kanter, "Collaborative Advantage: the art of alliances; successful partnerships manage the relationship, not just the deal," *Harvard Business Review*, July/August, 1994, p. 100.

4 Jon R. Katzenbach, *The wisdom of teams : creating the high-performance organization* (Boston, Mass.: Harvard Business School Press, 1993, p. 24.

5 Ibid., p. 30.

6 Mark Graham Brown, *Baldrige Award-Wining Qualifications: How To Interpret the Malcolm Baldrige Award Criteria* (Milwaukee: ASQC Quality press, 1992).

7 Philip B. Crosby, Quality Is Free (New York: McGraw Hill,1979) p. 15.

8 W. Edwards (William Edwards)Deming, Quality, productivity, and competitive position (Cambridge, Mass.: Massachusetts Institute of Technology, Center for Advanced Engineering Study, 1982.

9 Michael Hammer and James Champy, *Reengineering the corporation : a manifesto for business revolution* (New York : Harper Business, 1993, p. 11.

10 "The Harvard Quality Process", Harvard Office of Information Technology ("handout" at CAUSE '93 session)

11 Anita K. Lowry, "The Information Arcade at the University of Iowa", *CAUSE/EFFECT*, Fall, 94, p. 44.

12 University Advisory Committee on Academic Computing, Robert O. Watts, Chair, "Report on Library Computing at the University of Washington." February, 1990, p. 1.

13 Anne Woodsworth and Theresa Maylone, *Reinvesting in the Information Job Family: Context, Changes, New Jobs and Models for Evaluation and Compensation*, Cause Professional Paper Series, No. 11 PUB3011, Boulder, CO: CAUSE, 1993.

14 "The Harvard Quality Process", handout.

15 Connie Towler and Douglas Remick, "Change in the Trenches: Continuous Improvement of Service Processing," CAUSE, 1993.

16 University Advisory Committee on Academic Computing, p. 1.

17 Willow/Wilco are trademarks of the University of Washington. They are copyrighted, but are available free of charge. Information about the systems is available at: http://www.cac.washington.edu/willow/home.html

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Making Order Out of Chaos with a Computerized Lottery

Steven Anders Oakland
Massachusetts Institute of Technology
Cambridge, Massachusetts

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Abstract

All undergraduate students at MIT are required to take a certain number of "HASS-D" (Humanities, Arts, and Social Sciences Distribution) classes. The enrollment for each class is limited, leading to competition for spaces.

In the spring of 1994, the HASS office introduced a new system for assigning students to classes. Students ran an application (available on the approximately 800 Athena workstations, plus dialup servers) which allowed them to select up to six classes in order of preference. After students had made their selections, a lottery program made assignments, giving students as close to their top choice as possible, and sent email to the students telling them of their assignment.

The lottery has been run for two semesters, and has consistently given over 90% of students their first choice. Once we took a global view of the system, it turned out that there was no problem matching students with their desired classes.

1 Background

At the Massachusetts Institute of Technology, there is a requirement that all students take a certain number of humanities classes, to ensure that their education isn't *entirely* technical! These classes are referred to as the "Humanities, Arts, and Social Science Distribution" ("HASS-D") classes. Because each of these HASS-D classes requires more writing than is typical for MIT classes, and because the classes are expected to allow for more discussion than large lecture classes, enrollment in each class is limited to 25 students.

As of June of 1993, the system for selecting students was completely ad-hoc; students appeared at the first meeting of a class they were interested in, and if more than 25 appeared, the instructor used a lottery (or whatever other mechanism he or she wanted) to cut down the enrollment.

This was frustrating for both faculty and students. Faculty did not know how many students wanted to attend a particular section until after classes started, and often lost valuable teaching time running unpleasant lotteries. Students were forced to attend multiple classes or risk being shut out of their top-choice classes. If they were lotteried out of a class, they had to scramble to find another class with a vacancy. The result was general confusion for both students and faculty for the first few weeks of each term.

It was known that there was enough space in the offered classes for all students wanting a HASS-D to get one. However, the chaotic selection system obscured this fact, and produced the impression that there weren't enough seats to go around. With this in mind, the assistant dean of Undergraduate Academic Affairs came up with the idea of using Athena, the MIT academic computing system, as the infrastructure for a new package which would allow students to apply for classes and receive their assignments electronically.

2 Expectations

The expectations of this package were that it would:

- Let approximately 2000 students, using the Athena computer system, view a list of available HASS-D classes and rank their choices in order of preference. The selection package would remain running and allow students to make and edit their choices from the end of the Fall 1993 semester through the beginning of the Spring 1994 semester.

- Shortly before classes were to begin, the package would download the students' selections to an administrative PC, where statistics on over- and under-enrolled classes would be generated, and the lottery would be run.

- Finally, it would send the lottery results back to Athena, where all students would receive email telling them of their assignment. In addition, a file listing the classes which still had space would be made public, for those students

who were unhappy with their assignment or who wanted to take additional humanities classes.

3 Challenges

There were a number of challenges in designing and implementing this package, both in the "front end" (the student selection application) and in the "back end" (the administrative package used by the HASS office.)

First came the students' privacy. We required that the package be secure from snoopers who wanted to find out other students' selections and assignments. We decided to meet this requirement by using a Kerberized client/server architecture, with the database residing on a secure machine, and each student being authenticated to the package via Kerberos.

Because the application would be run only twice a year, it must be made as simple to use as possible. This was especially critical on the student side, as it would be impossible to give individual coaching to two thousand students. The package also had to be robust enough to survive a barrage of procrastinating students all making their selections at the last moment.

The package must be absolutely fair. We decided that all students would be treated identically. There would be no priority given to seniors, to students with particular majors, and so forth. Furthermore, the lottery algorithm should be proven robust and non-deceivable; that is, there should be no way to manipulate the package by making strange selections.

In addition, the HASS office had some specialized requirements for their part of the application. Because of their policy that a student lotteried out of a class one semester would be automatically admitted to it the next time it was offered, they needed a special report of students not receiving their first-choice class, to be used for reference the next semester. This, in turn, required that there be a "back door" for manually placing students into classes, to be used for the previously lotteried-out students, for desperate seniors requiring one more class to graduate, and the like.

4 Architecture

The package was partitioned into three major sections: The student portion of the package (the "front end") would run on the Athena Unix machines, and the HASS office portion (the "back end") would run on a 486 PC in their office. In addition, the lottery algorithm itself was prototyped and developed on the Unix side, but eventually run on the PC.

The "front end" included the following components:

- A front-end student selection client, in both Motif (for workstations) and Curses (for dialup) use. This client would present the available choices for HASS-D classes and allows students to select up to six of them, in order of preference.

Students would be able to revise their selections as many times as they wanted during the selection period.

- A database server, to maintain the student selection data. This server must use Kerberos authentication to secure its connection with the selection client.
- A collection of automated scripts to transfer data from the Athena enviroment into the back-end application, and vice-versa.
- An email package to send out the final assignments.

The "back end" application for the HASS office provided the following abilities:

- Remote configuration of the Athena client. (That is, turning the student selection client on and off, editting the list of classes available and the explanatory text, and so on.)
- Moving class and selection information back and forth between the front- and back-ends.
- Manually assigning students to classes.
- Producing reports, including class rosters, lists of over- and under-enrolled classes, and lists of students not receiving their first choice.

5 The Lottery Algorithm

We spent a significant amount of time selecting the lottery algorithm to be used for assignments. This type of bipartite matching is a well-known problem, informally known as the "stable marriage problem." We wanted to assign as many students as possible to their first choice, while not rewarding students who made only one choice. (Since we wanted to encourage students to make as many selections as possible.) After prototyping three algorithms and running them on data from previous years' student selections, we selected the one which appeared to be most appropriate. In informal terms, the lottery algorithm worked as follows:

- Begin by assigning all students to their first-choice class.
- Step through all classes which are now overenrolled. Randomly remove students from these classes until they are back down to their maximum enrollment.
- For each student who was removed, step down his or her list of alternate choices and assign this student to the highest choice with space available.

In this algorithm, a student's alternate choices are not looked at unless the decision has already been made to remove him or her from the class. Thus, making alternate choices only makes it more probable that a student will receive a desirable class if

he or she is lotteried out of the first-choice class, and does not reduce the chance of being assigned to the first-choice class in the first place. We publicized this algorithm widely, so that rumors of how to "fool" the lottery would not circulate.

Ironically, the choice of algorithm turned out to be almost irrelevant, because there were enough spaces for almost all students to get the classes they most wanted. No matter which algorithm was chosen, it would have had an effect on very few students.

6 Development

Coding of the package, with two developers working half-time, began in September 1993. The Athena portion of the system was complete and operational for December of 1993, so that students could begin making their selections as they completed their final exams. The administrative portion was completed shortly thereafter.

7 Running the System

Each participant in the system has a limited, simple, view of how the system works. As a particular student would see the system, she ranks her choices from a list of classes, being sure to list in first place the class she has pre-registered for with the Registrar's office. Just before classes begin, she receives her lottery assignment by email. From the HASS office's perspective, they begin by sending out the list of offered classes and some explanatory text, and later collect the students' choices. After running the lottery, they send the results to three places: The students, the professors, and the Registrar's office. An individual professor simply receives a piece of paper with the class roster on it, and the Registrar's office receives a list of students not receiving their first choice, so that the students' pre-registration information can be updated.

The system, though, is actually more complicated than perceived by the participants. Figure 1 shows a schematic view of the system. Each virtual component of the system is depicted by a box, and the numbered arrows indicate the flow of information between components.

7.1 Preliminaries:

The selection process requires some manual operations each time it is started. First, an administrator for the database server machine must clear out the database of all previous student selections, and the HASS office must supply some configuration files for the selection client.

The HASS office has control of all text appearing on the front-end client's screen. (Figures 2 and 3 show the main screen as seen by the students.) Each semester, the office must send over the text to appear on the welcome screen, the list of classes to select from, and the text which appears above the list of classes. (The office can change this text at any time, even after the selection process is already in progress.) They

also can turn the client on or off remotely. The movement of these configuration files is shown as arrows 1, 2, and 3 in Figure 1. They are sent via FTP ("File Transfer Program") to a transfer point on an Athena workstation, where a periodic script checks for new arrivals and moves them to a public location in AFS ("Andrew File System") space. Once these files are in place, any student running the enroll or xenroll application will see the latest information.

7.2 Making selections

Once the database has been cleared and the client configured, the HASS office turns on the application. This is typically done at the end of the semester, so that students can make their choices for the next semester as they complete their exams or during break.

For the remainder of the selection period, the package operates automatically. As students make their selections, they are stored in a database on the Athena side. A script on the database server machine periodically copies the contents of the database to the FTP transfer point, where the HASS application can take them. This process is shown via arrows 4, 5, and 6 in Figure 1.

7.3 Running the lottery

At the end of the selection period, the HASS office turns off access to the selection client. Getting a final copy of the database contents requires a phone call to the administrator of the database server machine, to make certain that no students are still running the client. (Work in progress is not stopped when the HASS office deactivates the client, and there are always several students still working at the deadline!)

After the last students have saved their choices, the HASS office takes a copy of the database onto their package. (Arrow 7) They then do whatever manual operations are necessary, such as assigning students who were lotteried out of their first choice last year, and then run the lottery. After examining the results, if everything looks sane, they transfer the results back to Athena (Arrows 8 and 9), and begin printing out their class rosters. (Arrow 12)

7.4 Sending out the results

For the next few hours, two processes operate in parallel. On the Athena side, the database administrator begins a script which steps through the list of class assignments and sends out email to each student with his or her assignment. (Arrow 10) To avoid clogging the mail servers, these messages are sent at a deliberately slow pace (roughly one every six seconds) which means that it takes three or four hours for all messages to go out.

Simultaneously, the HASS office prints out rosters for each of the several dozen classes. They also determine the list of classes which still have space available (the threshold for "available" is adjustable) and send this list to Athena, where it can be

viewed by those students who are either unhappy with their assignment or simply are looking for an additional class to take. (Arrow 1, since this counts as a configuration file.) Finally, as a convenience for the students, they create a list of students not receiving their first choice, along with the class that they *were* assigned, and provide this list to the Registrar's office so that the students' official schedules can be updated with the assigned classes. (Arrow 11)

8 Outcome

In the first running of the package, we included a one-week lag time between halting the selection client and running the lottery. During this week, the HASS office identified oversubscribed classes, and asked the departments to consider adding sections to them. As a result of this, four sections were added, providing an additional hundred seats in the most popular classes! When the lottery was complete and the smoke cleared, 93% of students had received their first choice.

The following semester, we decided to eliminate the one-week lag time and to send out assignments almost immediately (twelve hours) after taking the choices from Athena. This time, even with no extra sections added, "only" 90% of students received their first choice! Table 1 summarizes the results of the two lottery runs.

	Spring 1994		Fall 1994	
Total students entering	1206		2014	
Receiving 1st choice	1119	(93%)	1806	(90%)
Receiving 2nd-6th choice	64	(5%)	126	(6%)
No assignment	23	(2%)	82	(4%)

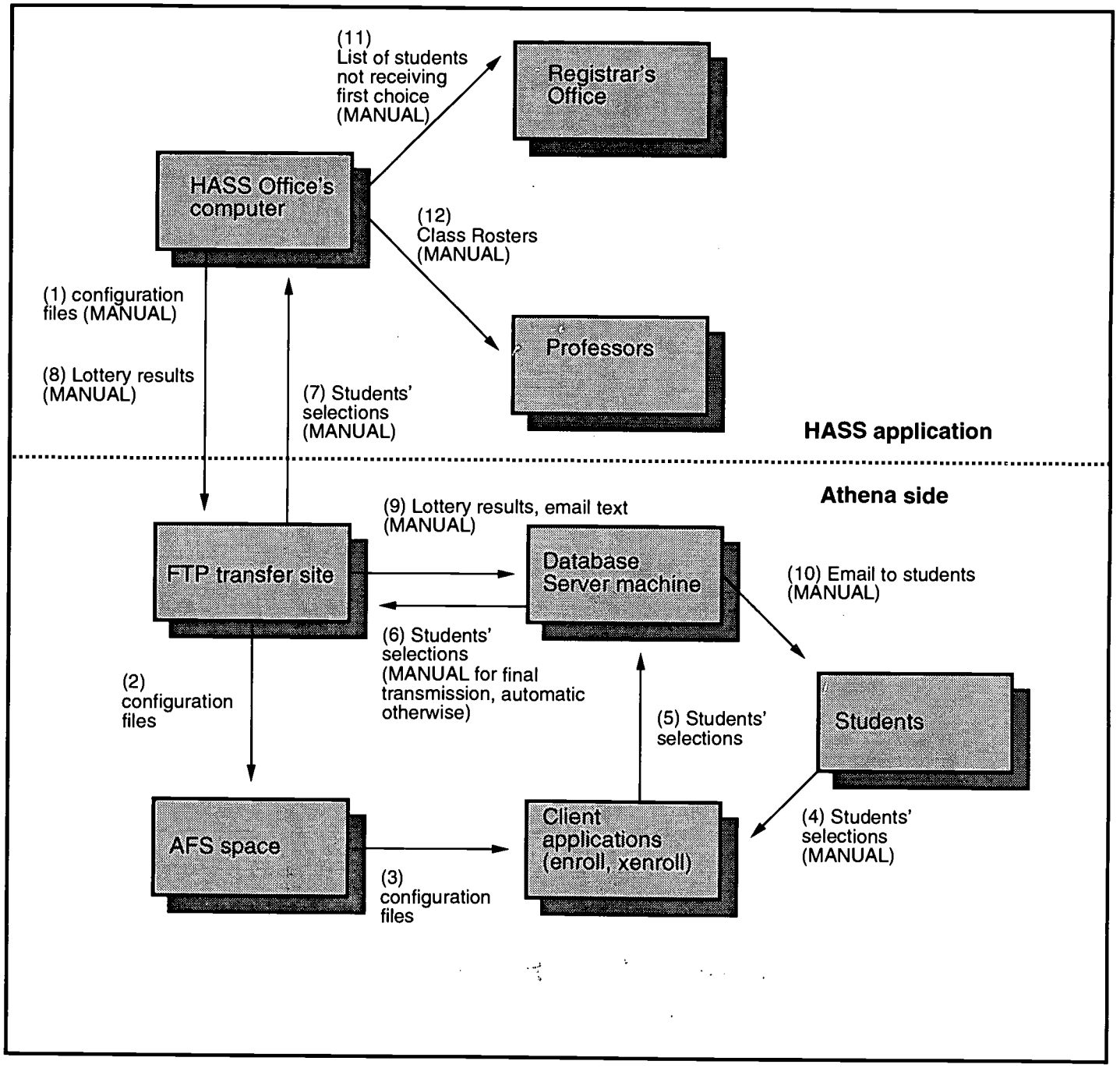
Table 1. Rank of assignments given to students

These results show that, in spite of students' previous perceptions, there in fact was no serious mismatch between the classes offered and the number of students wanting to get into these classes. Even for the second use of the package, when we did not add any additional sections, the vast majority of students were able to get into their first choice class.

The previous start-of-semester chaos had merely been an artifact of the old process. Once we took a global view of the assignment process, it turned out that there was no problem matching students with their desired classes. But the only way to discover this was to look at the process as a whole, and not from the viewpoint of individual students and instructors.

We consider the HASS-D lottery package a great success! We have used a variation of the package in Fall of 1994 for the Freshman housing lottery, which also went much more smoothly than before it was computerized. We believe the next step is to make the package into a generalized lottery system, which will no longer require a knowledgable Unix administrator to set up and run it.

Data flow for HASS-D lottery system



All operations begun manually or requiring human intervention have been flagged with "MANUAL." Otherwise, data flows automatically via a variety of cron entries. Step 6, the final transmission of students' selections to the HASS application, requires a large Moira query to be run in order to expand the Athena logins into MIT ID's and full names, and is done once only. Interm transmissions are automatically sent with dummy data in the ID and name fields.

Figure 1. Data flow in the HASS-D lottery system

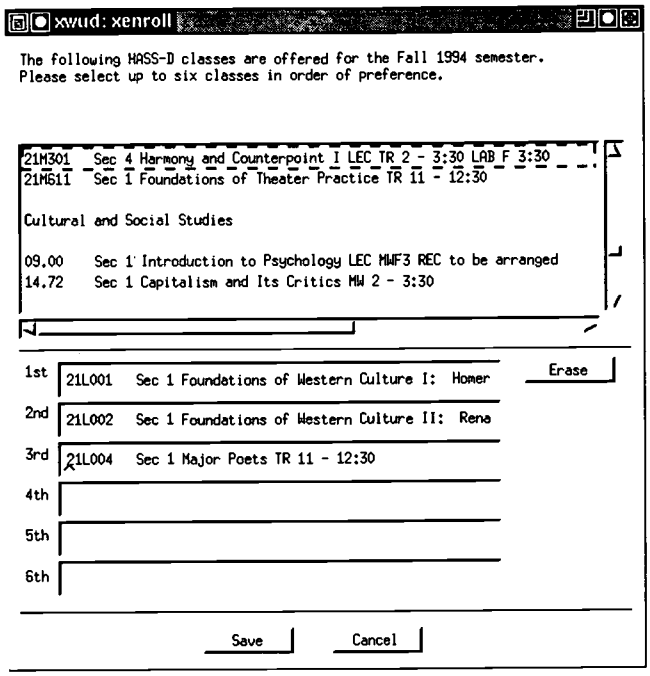


Figure 2. Motif version of student selection client

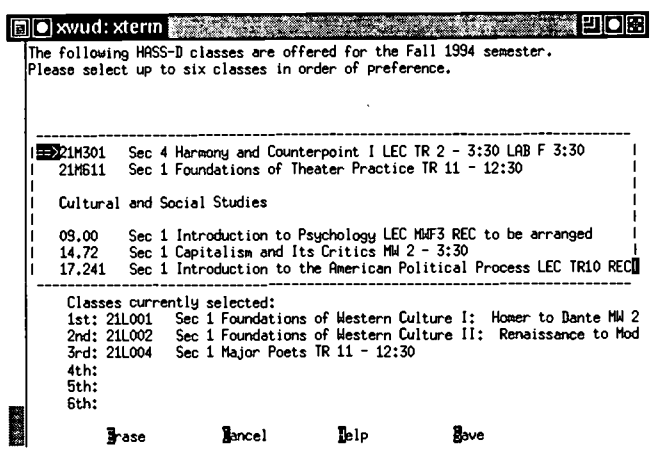


Figure 3. Curses version of student selection client

CUSTOMERS AS PARTNERS IN THE INFORMATION TECHNOLOGY PLANNING PROCESS

Linda Jorn
Roberta Armstrong
Charlene Mason
Don Riley

UNIVERSITY OF MINNESOTA
Minneapolis, Minnesota

The Information Technology Planning Project at the University of Minnesota included a large-scale customer needs assessment. This presentation provides background on the Project and highlights how customers were involved in planning. Techniques included a Customer Council, focus groups that concentrated on particular customer roles (e.g., administrative, research), a customer survey which collected information on technology use and priorities for information technology initiatives, and a series of visionary "think tank" sessions which brought industry and higher education leaders to campus. We discuss project findings, note comparisons between customers and information technology providers, and outline impact of the project on the University.

WHY DO A STRATEGIC INFORMATION TECHNOLOGY PLANNING PROJECT?

> *"All too often, computing plans are focused on technology itself, rather than on how technology enables faculty and students to achieve some of the key instructional or research goals of the institution. If it is to have a strong chance of succeeding, the plan cannot be distinct from or tangential to the overall academic mission of the university—indeed, the plan must flow from an understanding of the mission..." Hawkins (1989, p. 231)*

At the University of Minnesota, we realized the need for a strategic information technology plan to guide future planning and investments in information technology and to support the University's mission in teaching, research, and outreach. Both the University and the field of information technology are changing, and changes in both arenas impact future computing and information strategy. To remain a premier institution, the University must have a well-defined information technology strategy that creates an integrated electronic environment with cost-effective decisions about resources.

Like other institutions (Breivik, 1994; Fleit, 1994) we wanted to talk with our faculty, staff, and students about their work and how information technology supports what they do. We did not want to conduct a self assessment of information technology services; we wanted to discover the needs of customers and how information technology supported these needs now and in the future.

Therefore we embarked on a strategic information technology planning project that allowed us to obtain in-depth, qualitative and quantitative information on customer needs. Originally we envisioned an ambitious five-step process: review University strategic direction, assess customer needs, assess the existing information technology investments already made by the providers of information technology, develop strategic information technology architecture, and develop tactical implementation plans.

In this paper we will mainly discuss the one-year process for assessing customer needs, but also will describe how we engaged information technology providers in this process. In addition, we will present our findings and discuss the project's impact on the University.

HISTORY

The process for defining an information technology strategy for the University of Minnesota community began in 1992 when senior University management created an Advisory Users Committee (AUC), with a charge to create a vision of computing and information technology for the University. The AUC vision states:

> *We envision an electronic environment, a common space, that invites members of the University community to make use of distributed information technology in realizing our land-grant mission. In addition we wish to involve members of the community at large in this collaboration. This environment will be tolerant of diverse computing platforms, provide access to global information resources, and will value innovation. (August 12, 1992)*

The vision along with some preliminary strategies for achieving it received endorsement from the University President's Cabinet, the University Senate Committee on Computing and Information Systems, and the University Senate. The vision was widely shared with academic units and key University information technology personnel.

To implement the vision, senior management chartered an Information Technology (InfoTech) Steering Committee, which recommended an approach focused on establishing the linkage between the University's strategic requirements and its ability to use information technology and to address the needs of academic and administrative units. The Steering Committee consisted of the Associate Vice President for Academic Affairs, the Associate Vice President for Finance and Operations, the Director of Administrative Information Services, a former chair of the Senate Committee on Computing and Information Services, and the two co-chairs of the InfoTech Planning Team. The Steering Committee then chartered the InfoTech Planning Team consisting of people from academic and administrative computing, student affairs, university networking, libraries, graduate school, and collegiate unit instructional computing.

To begin the project, we conducted an internal and external environmental scan: internally by reviewing University strategic planning efforts and previous information technology planning documents, and externally through review of peer strategic plans.

At about the same time the information technology planning process was beginning, the University of Minnesota was starting to transform its vision, "University 2000 (U2000): A Road Map to the 21st Century," into plans and reality. The U2000 vision describes a University committed to improving its position as one of the world's premier research universities, improving the environment for teaching and learning, enhancing its commitment to service and outreach, providing a user-friendly environment, and expanding its commitment to diversity. The University is developing and using criteria for measuring its success in meeting these objectives. We reviewed U2000 planning documents, kept informed, and shared information with the U2000 planning committee throughout the project.

The team also reviewed 11 previous information technology planning efforts at the University of Minnesota and created a "Common Themes" report that highlighted issues that occurred in more than one report. Among these common themes were needs in the following areas: goals and vision, an appropriate organization to support information technology, integrated planning, appropriate funding models, better use of human resources, information technology standards, infrastructure support, user support, better access to institutional data, and applications to support the mission.

We also conducted a thorough review of peer strategic plans. The team reviewed profiles of strategic directions, innovative projects, organization structure, and funding models from other universities by looking at publications from such resources as EDUCOM, CAUSE Information Resources Library, Coalition for Networked Information (CNI), Corporation for Research & Educational Networking (CREN), CICNet, MRNet, HECB Telecommunication Council, and the METNET telecommunications consortium. We continued to track developments in these areas as the project progressed.

While conducting this environmental scan, we rarely found detailed information on *how* data was collected from customers. Early on we decided that it was important to not only obtain information from customers, but to allow customers to engage in conversations and share information with people from multiple disciplines. Therefore, we created a formal project organization and process for collecting customer information to achieve this goal.

HOW DID WE INVOLVE CUSTOMERS AS PARTNERS?

Customer Input Organization

We had three objectives in developing our method of obtaining information from customers and providers: obtain in-depth, qualitative and quantitative information on customer needs; validate the AUC vision; and promote sharing of information. To help us with this process we formed and worked with a Customer Council, Customer Council Liaison Group, and Provider Council. Three separate Listservs allowed efficient and effective communication with these large and diverse groups about meeting dates, project updates, and change in plans.

Customer Council. The Customer Council consisted of 150 individuals nominated by their college dean or chancellor (up to 4 people from each college with a balance of faculty, administrative staff, technical staff, and students) or central administrative department head/director (up to 3 members). Customer Council members were invited to participate in the project through involvement in focus groups, through council meetings, and through filling out a survey.

Liaison Group. We created a 15-member Customer Council Liaison Group as a representative subset of the full council. This Liaison Group met with the InfoTech Planning Team to review approaches to gathering data and was heavily involved by providing substantive and constructive feedback on the structure and content of drafts and final drafts of our written reports.

Provider Council. We created a 15-member Provider Council from the large central units important in the information technology infrastructure on campus—academic computing, administrative computing, telecommunications, libraries, media resources, and printing and graphics. Providers met to discuss their technology perspective and experiences with information technology at the University of Minnesota, discuss the customer assessment findings, and to fill out a survey.

Data Gathering and Information Sharing Techniques

After talking with four University of Minnesota national experts on strategic planning, we decided on the following techniques for reaching our goals of data gathering and information sharing:

Technique	Purpose
Focus groups (Customer Council)	-obtain qualitative data focused on information technology needs -provide an environment in which people could engage in conversations that would impact their own view of information technology needs (Krueger, 1988)
Revision/Feedback sessions (Liaison Group)	-provide feedback on data gathering and information sharing techniques -provide substantive feedback on drafts of reports
Survey (Customer and Provider Council)	-provide quantitative information on customer use of information technology -provide a prioritization of possible "next step" actions the University could take to meet information technology needs

Monthly Council meetings (Customer and Provider Councils)	-share preliminary and final data analysis and progress of strategic planning efforts -provide "visionary think tank" sessions. We invited leaders from industry and higher education to campus, including speakers from DEC, IBM, Apple, US WEST, Silicon Graphics, the Blacksburg Electronic Village project, and the Universities of Indiana, Wisconsin, and Michigan -share information and develop future collaborative partnerships

Early in our process it became clear that many people had difficulty envisioning how they would be working and using technology in five years. Many were caught up in day-to-day tasks of using the information technology already on their desktops, finding money to upgrade hardware/software, or hiring research assistants. Therefore we decided to schedule the think tank sessions in order to stimulate visionary ideas among the council members. These meetings also allowed people from multiple disciplines to meet, listen to and discuss new ideas, and share information.

FOCUS GROUPS

Process

We conducted 21 focus groups from August through October, 1993. Ninety eight people attended the focus groups (some attended several). An outside consultant with skills in strategic planning and focus group facilitation moderated the focus groups; InfoTech Planning Team members served as assistant moderators. Participants self selected into the following functional roles and corresponding focus groups: administrative (49 participants), instructional (18), outreach (17), research (16), and student (19).

A pilot focus group was conducted to refine our procedures and questions. Focus group participants completed a pre-focus group survey, which requested that they read the AUC Vision and begin thinking about their information technology needs. The focus group questions asked about their current work environment and information technology use, future requirements, exciting information technology projects, and their reaction to the AUC vision statement.

During the focus groups, assistant moderators took notes and tape recorded the session. After each focus group, the assistant moderators collected completed pre-focus group surveys (68 total). Through re-listening to the tapes and reviewing their notes, they created organized notes for each session, which maintained confidentiality in participants' responses and included information from the pre-focus group surveys. The consultant reviewed and provided feedback on all organized notes.

One team member then took the organized notes from a functional area (e.g., administrative, instruction, outreach, research, or student) and created the report for that area, incorporating feedback from the consultant, InfoTech Planning Team members, and Customer Council Liaison Group members.

Reports

As stated above, we created five functional reports that provided *detailed* information about administrative, instructional, outreach, research, and student needs. The reports had three parts:

- specific examples of information technology use
- comments on what is working and not working in terms of information technology
- key information technology challenges and next steps the University should take in order to meet customer work needs

We also created an overall summary report from the focus groups, *Summary of Focus Group Findings.* The purpose of this report was to highlight common findings between all functional groups and to present our recommendations for future information technology planning.

Finally, we created an 11-page list of exciting information technology projects in which customers are involved at the University of Minnesota. In addition to the name of the department related to the project, this list included a brief description of the innovative use of technology for administrative, instructional, outreach, research, or student use.

SURVEY

Process

A survey on customer use of information technology and prioritization of possible "next step" actions for the University was conducted in late January and early February of 1994. Response rates were 67% for the Customer Council (96 surveys) and 77% for the Provider Council (10 surveys).

The InfoTech Planning Project Team worked with many groups to develop this survey. Customer Council members assisted in developing the items on proposed next steps through participation in small groups at a Customer Council meeting; groups were assigned the task of listing and prioritizing the things the University should do to better support information technology. From these lists, review of other survey instruments, review of focus group suggestions for next steps, extensive discussion with the project team and Steering Committee, and input from information technology experts at the University, the survey was refined.

In the survey, respondents were asked about their use of information technology and then asked to rate a variety of actions the University could take to improve information technology usage. We grouped these actions into three broad categories: (1) General Services (including Information Technology Infrastructure, Labs and Facilities, and Consulting Support); (2) Specific needs/activities, and (3) Policy & Planning (Information Technology Policy Development, Funding, and Vision & Planning).

The picture of our customers that emerged was that of a group with primarily administrative duties (51% of the sample), although half of the sample also reported either primary or secondary job duties in instruction or instructional support, outreach, or research or research support. Relatively few of the group (about 5%) reported that being a student was their primary role. The group was almost evenly split between men and women, and most of the group (78%) ranged in age from 30 to 49.

Reports

We created a report, *Findings from the Information Technology Customer Survey,* from the survey results. This report provides a:

- Description of how customers use technology (e.g., hardware, software, networking needs)

- Prioritization of possible "next step" actions the University could take to meet information technology needs
- Discussion on agreement between providers and customers on the priority of next steps

WHAT DID WE CONCLUDE FROM THE CUSTOMER ASSESSMENT?

Detailed accounts of our findings can be obtained by asking for our reports from the CAUSE Information Resources Library (see Bibliography for titles). Below, we briefly describe major highlights from our focus group and survey findings.

Focus Group Findings

In the *Summary of Focus Group Findings* report we provided the President's Cabinet, deans and unit managers with an executive summary highlighting five major findings from all focus groups:

1. Information technology supports a wide range of user activities and extends throughout the University community. Participants provided many examples demonstrating how information technology assists in their activities, and helps them reach local, state, national, and global communities.

   Participants emphasized that information technology is pervasive and provides opportunities to build new relationships. Participants stressed that without information technology they literally could not do most of their work and that it is technology that gives them a competitive edge.

   Participants stated that information technology supports the daily functions of communicating, collaborating, writing, visualizing, and working with information, all of which facilitate the creation, sharing, and preservation of knowledge. Participants made it clear that their use of information technology requires a continuum of information technology based on the context of use.

2. Participants described common attributes needed in order for them to be productive in their work environment and provide the foundation for future information technology planning. Participants want information technology systems and services that are: accessible, user focused, accountable, reliable, timely, easy to use, flexible, and accurate.

3. Participants discussed five key information technology challenges the University needs to address so that people can be successful in their work:

   - Assess and address the information technology **support** we need.
   - Develop **environments** that allow us to efficiently and effectively use information technology to conduct daily functions that support key University activities.
   - Develop appropriate **policies** to meet our information technology needs.
   - Develop **funding models** to meet our information technology needs.
   - Develop an appropriate **organizational structure** to meet our information technology needs.

   In addition to key challenges, participants provided many examples of specific next steps that administrators, providers, supporters, and users of information technology could implement in order to meet key information technology challenges. We shared these next steps with University providers of information technology for their planning use.

4. In general, users supported the AUC vision and major objectives. Participants viewed information technology planning as important and wanted it to continue.

5. Participants discussed in degrees of detail current exciting projects that administrators, instructors, outreach personnel, researchers, and students are implementing. We published this list on the University of Minnesota Gopher.

Survey Findings

The survey provided us with a rich amount of data indicating that customers and providers of technology considered most "next step" items important. We choose two key questions to examine to summarize the data in a useful way for management and central administration:

- Which items do customers and providers consider to be top priority?
- Do customers and information technology providers agree on the priority of next steps?

Which items do customers and providers consider to be top priority? Table 1 below lists the top four items for customers and providers and each item's average rating. It is interesting to note that all but one of these items are policy and planning items. One item refers to general services, specifically consulting and support. Customers and providers seem to value policy and planning efforts. Both customers and providers want the need for information technology at the University promoted to the legislature. They also agree that we need more funding for developing the people resources that support and use information technology.

Table 1. Top four items for customers and providers
(Based on average rating—Top priority, do now (4), Valuable, do soon (3), Useful, but not critical (2), and Not necessary (1))

Item	Cus-tomer	Pro-vider
Customer and Provider "Top 4"		
Promote the need for information technology at the University to the legislature.	3.7	3.9
Provide more funding for developing the people resources that support and use information technology.	3.5	3.7
Customer "Top 4"		
Provide a place for information technology planning in U2000 and ongoing strategic planning efforts throughout the University.	3.6	3.6
Ensure disaster prevention/recovery plans for centrally-provided information and services are in place.	3.5	3.1
Provider "Top 4"		
Reorganize information technology units under strong leadership.	3.1	4.0
Provide more help line/help desk service to adequately cover times of peak demand.	3.4	3.7

Do customers and information technology providers agree on the priority of next steps? Overall, we concluded that the providers do have a good sense of what their customers need. Despite the overall agreement among customers and providers, there were a few items whose average ratings differed by .4 or more, which suggest areas where customers and providers may differ or may need to educate one another. These are shown in the Table 2 below; items where the difference was statistically significant are marked by **.

Only four of these items had a 3.3 or above rating by either the customers or providers, and of these four only two had a significantly different rating. Customers feel more strongly about the need to ensure disaster prevention/recovery plans for centrally-provided information and services, and providers feel more strongly about the need to reorganize information technology units under strong leadership. Both of these items need to be addressed. In all cases, customers and providers need to articulate *why* these needs are top priority.

Table 2. Customer and Provider response differences (.4 or more)
(Based on average rating—Top priority, do now (4), Valuable, do soon (3), Useful, but not critical (2), and Not necessary (1))

Category and item	Cus-tomer	Pro-vider
Information technology infrastructure		
Strengthen campus network security (e.g., break-ins, forgery, eavesdropping).	2.9	3.3
**Ensure disaster prevention/recovery plans for centrally-provided information and services are in place.	3.5	3.1
**Provide services and support that will facilitate disaster prevention/recovery planning in individual units.	3.1	2.6
Consulting and support		
Expand help desk/help line coverage to include evenings and weekends.	2.8	3.3
Provide basic information technology training as a part of staff orientation and freshman core curriculum.	3.1	2.7
Improve support for user selection of hardware and software (e.g., clarifying requirements, documentation, consultation).	2.8	3.2
Broaden expertise of support staff to include high performance workstations.	2.7	3.1
Broaden expertise of support staff to include adaptive technology (e.g., Braille output, voice synthesizers).	2.4	2.9
Specific needs and activities		
**Provide more extensive on-line hours for major administrative systems (e.g., student records, LUMINA).	3.0	2.4
Information technology policy development		
**Reorganize information technology units under strong leadership.	3.1	4.0

WHAT IMPACT DID THE PROJECT HAVE ON THE UNIVERSITY?

While it is not always possible to clearly identify outcomes from the project, we believe that the project's work and the relationships that it has fostered have been instrumental in a variety of areas.

1. **Impact on University 2000 strategic planning.** During the planning project we shared preliminary findings and project progress with the U2000 University-wide planning team. Final project reports were distributed to all deans, along with other U2000 strategic planning documents, as part of collegiate planning instructions. We presented our findings to the Deans' Council and discussed the InfoTech strategic planning effort needed to ensure customers have access to the information technology they need in order to be leaders.

2. **Providing impetus for ongoing information technology planning.** Several on-going commitments resulted from the Project. The senior vice presidents have agreed to focus information technology planning. Our Associate Vice President for Academic Affairs has established an ongoing staff position for Information Technology policy development, planning, measurement, and evaluation. An Information Technology Advisory Council and ongoing Customer Council, along with cross functional working groups, will support the planning efforts.

3. **Impact on budget planning.** Project data were used in three of the four major themes in a request to the legislature for additional funding. And information technology is prominently featured in the biennial request submitted in October, 1994.

4. **Creation of new relationships and cross functional collaboration.** An added benefit was the collaboration among team members, Customer Council, and Provider Council. We viewed many episodes of business card swapping and heard people share ideas about pedagogical practices, hardware tips, software advice, multimedia classroom access on campus, and new administrative processes and policies.

5. **Prototype multimedia projects.** Students in a Rhetoric Multimedia Document Design course had the opportunity to develop three- to five-minute multimedia presentations highlighting six of the exciting information technology projects discussed during focus groups. Students in this course targeted the President of the University of Minnesota as their main audience. They were asked to develop short presentations that the President could use to highlight how information technology, as demonstrated by these exciting projects, is helping the University accomplist its missions of teaching and learning, research and discovery, and outreach and service. The students interviewed the faculty and designed and developed the multimedia presentation. This proved to be a stimulating learning experience for students: they engaged in active learning; worked in groups; interacted with a "real" audience, someone besides the instructor; learned multimedia computer skills; considered multimedia design issues; and presented their final projects to high-level University administrators.

6. **Digital Media Center.** A new Digital Media Center, which will provide technical and design support for faculty and staff using multimedia for teaching, research, and outreach, will open in early 1995. Specific goals include providing central staff and services to help faculty and teaching assistants bring multimedia technology to the classroom, serving as an umbrella organization for research, investigating how new technology enhances teaching/learning, and providing state leadership for "train the trainer" programs.

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Distance Education:

What's Up?

by
Gene T. Sherron, D.B.A.
School of Library & Information Studies
Florida State University
December 1994

DISTANCE EDUCATION: WHAT'S UP?

By the year 2000, multiple and seamless links will exist between homes and industries, driven by the converging computer, communications and television technologies. Coupled with telecomputer, telephonic TV, cable and satellite access, such evolutionary phenomena will soon permit widespread availability of diverse forms of information, education, services, and entertainment for all.[1]

SOME THOUGHTS ABOUT LEARNING

If Rip van Winkle were to drop in on one of our classrooms today he would probably feel right at home.. In the front of the classroom is a single, isolated instructor still using a chalkboard with little else to support his/her craft. After all, this approach has endured for hundreds of years and there is almost no convincing evidence that either television or computers has changed the basic instructional model or challenged its underlying academic culture. So, why bother?

A reality check would say that today's instructor is not a dedicated craftsperson, but a highly-trained professional needing the technological support of a wide range of developers and resources. We must understand that technology can give us the management and instructional resources that enable us to meet the needs of every student, not just the few who would learn without us. We should be using technology to increase faculty productivity and student performance.

The question to be asked is not whether to use the technology, but rather how best to use the technology.[2]

DEFINING DISTANCE LEARNING

It is probably an understatement to say that there are as many definitions of distance learning as there are techniques for teaching. Perhaps, it will suffice to say that distance learning involves a wide spectrum of techniques, methodologies, and media. As a minimum, it is usual to describe distance learning as instruction that involves more than one of the senses, has an educational purpose, and includes several modules of instruction, taught over time. A more formal definition follows:

Distance education can be broadly defined as the transmission of education or instructional programming to geographically dispersed individuals or groups.[3]

Given this generalized definition, distance learning has been in existence for decades and now appears to be on an up-swing. Correspondence courses, the earliest form of distance education, began in the late 19th Century and was formalized an as institutional option as early as the 1930s. Instructional television was a much-touted distance learning model in the 1960s. However, ITV fell far

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[1] Alexander Schure, "Towards a New 'Distance Learning' University," T.H.E. Journal, March 1994, p. 32.
[2] Terry Kolomeychuk & Diane Peltz, "Assessing the Effectiveness of Interactive Compressed Video at the University of Minnesota," TDC Research Report No. 20, University of Minnesota, December 1991, p. 4.
[3] U.S. Congress, "Linking for Learning," Office of Technology Assessment, cited in Florida Distance Learning Report, Tallahassee, FL, March 17, 1992, p. 7.

short of early expectations. Perhaps, today's telecourses and educational programs will reach many new learners in diverse settings.

Thus, distance learning takes many forms. From voice and audio-graphics teleconferencing to microwave networks to full-motion video, distance learning has many levels of sophistication, interactivity and costs. ***No one delivery mode is superior to all others.*** Each system has its pros and cons. Research has shown that learning can take place with all types of distance education systems. But, some subjects lend themselves to certain systems better than others. Cost is also a prime consideration in choosing a delivery system. Most institutions engaged in distance learning programs will ultimately find themselves employing many different techniques, technologies and methods to accomplish its educational missions.

OVERCOMING RESISTANCE TO CHANGE

Regardless of the noble motivation, change is something we humans resist. Thus, going into a program of teaching at a distance will evoke reactions from the participants in ways that are hard to rationalize. Which is the point. Many reactions or responses are not rational. But, we should be prepared for them and ready to work through them. Lack of know-how, loss of control, and loss of privacy are grounds for educators' reluctance to embrace distant learning programs.

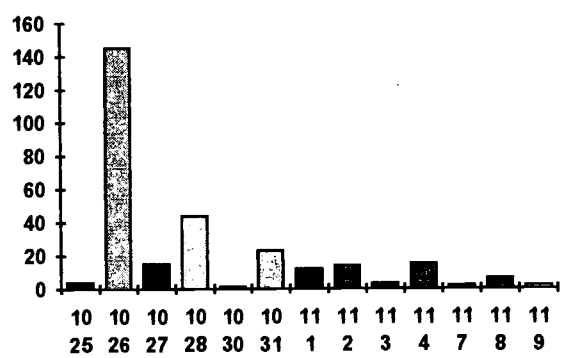
A SURVEY OF DISTANCE LEARNING

Against this background on distance learning, it became apparent that theory and observation can only take you so far. Thus, it was decided to do a brief survey of colleges and universities to see how things are going in distance education. Rather than follow the traditional, extensive, rigorous experimental design methodology and sampling process, a quick and dirty e-mail survey was used.

Through the auspices of CAUSE and its Institutional Database resources, a six-question e-mail survey was sent to the 850 or so campus "institutional representatives." The survey design was patterned after the highly effective CAUSE Postcard survey that has been used for several years to sample issues in higher education IT.

Survey details. On October 25th, the Internet spread this survey out all over the world. The survey produced 300 responses or a 35 percent response rate. Interestingly, the Internet respondents made 50 percent of their replies in the first 24 hours. The chart below shows the frequency of response on the vertical axis and the date (month/date) across the horizontal axis.

E-mail Response Times



Also, of interest was the 10 percent response coming from international CAUSE members. Finally, in this area, about 6 percent or over 50 responses came back by FAX. This reflects that the campus rep has an Internet connection but the people working in distance education probably don't.

DISTANCE EDUCATION IS "IN"

The basic question in any topical survey is whether it is "in" or "out." Intuitively, we know that higher education is into distance education and has been since the 1930's but how big is it?

Credit and Non-credit Programs. When asked the question, over ***55*** percent of the respondents said that their campus was involved in distance learning--the majority doing ***credit*** courses, but half of those involved in distance education were also doing ***non-credit*** programs.

CAUSE asked this question during the development of its ***1994 CAUSE ID Survey***. With a 38 percent response rate, they reported that ***57*** percent were involved in distance learning.[4] So, keep in mind that the following discussion of responses refer to about ***165*** colleges and universities that "do" distance education.

Courses and Enrollment Per Semester. Another interesting aspect of these programs is that when they get started, they seem to be fairly large. For example, on average, campuses engaged in distance learning offered ***22 courses*** each semester. In terms of student enrollment, the campuses reported that they had an average of 500 plus students enrolled each semester.

Planning to Get Started in Distance Education. There were 42 percent of the institutions that indicated that they were not involved in distance education. Of those, half of them said that they plan to get started in distance education within the next 3 years. And, almost all (98 %) of those doing distance education said that they would expand their programs over the next 3 years. One could conclude that distance education is on the move.

As a means of reviewing the various options in distance learning available and in use today, the following section provides such a review.

A REVIEW OF DISTANCE LEARNING OPTIONS

A comprehensive and complete review and discussion of all the options that can be a part of distance learning is an heroic goal to be accomplished in a few pages. So, what is provided is a list of the options, as a means of demonstrating that range. Then, some of the options are discussed in their particular situations. Finally, it should be observed that the technology is moving at such a pace as to make it impossible to say that this is anything more than a snapshot of today's options.

- **"Remote" the Facility**
- **Correspondence**
- **Audio Conference**
- **Electronic White Boards**
- **Computer-Networked Interaction**
  - **Internet Linkages**
  - **Bulletin Board Systems**

[4] Janet Munson, Randy Richter, & Mike Zastrocky, CAUSE Institution Database 1994 Profile, Boulder, CO: CAUSE, November 1994, p. 123.

- **Video-Based Education**
  - **Video Tape (video taped lectures)**
  - **Broadcast Video**
    - **Local Origination Channel TV**
    - **Private (University) Broadcast**
  - **One-Way Video/Two-Way Audio**
  - **Videoconferencing**
  - **Two-Way, Interactive Video**

Again, as mentioned above, rather than discuss each of the distance learning options, the following section contains a few vignettes of how these approaches are being used in colleges and universities today.

A Discussion of Some of the Distance Learning Options

◆ "Remote" the Faculty

One of the simplest ways to teach in remote locations is to move the faculty to the distant learning site or hire adjunct faculty on location for that purpose. For the most part, this is probably the good model to use for many subjects where the instructor is the "subject matter."

◆ Correspondence

The use of correspondence courses as a means of reaching distant learners around the world has been in use for decades and most especially since World War II when many veterans were hurrying to complete their educational void. Also, the easy access to air mail played a key role in speeding up this method of learning. What distinguishes the correspondence learners are that they have to be self-motivated and disciplined. They have to be the type of student that learns by reading and writing. Listening and speaking are not part of the process. Further, they miss the opportunity of social interaction and learning from other students.

◆ Computer-Networked Interaction

Thomas Edison State College (NJ) has developed a system of high-quality, flexible, and accessible undergraduate education supplemented by a computer delivery initiative called ***Computer-Assisted Lifelong Learning*** or CALL. The Guided Study program provides students with semester-based independent learning courses. Students receive a course syllabus and various learning materials, usually a combination of basic texts, video materials, and learning guides.

As a real-life, time-proven distance learning application, consider this approach for enhancing mathematics at Florida State University. For decades and perhaps centuries, this type of instruction has consisted of the teacher working problems in class and the students practicing that skill in-between classes. To make the process more focused, this FSU instructor started to use the ***Internet*** with his class. All assignments were given in that manner and the student could ask questions of the instructor with an expectation of a reply within 24 hours. This system improved instruction and the success rate of the students for several reasons. First, the instructor was more in tune with the problems of the students and could teach to their need. Secondly, the students felt a personal interest was given them, even if through a computer.

◆ **Video-Based Education**

Some states, like Florida, have spent a considerable amount of money building an infrastructure to promote distance education. There are currently over 100 ITFS (Instructional Television Fixed Service) channels licensed to educational institutions. A satellite network, called SUNSTAR, has placed steerable C and Ku band satellite receiving dishes in 35 sites, including one at each of the 28 community colleges service areas.

• **Videoconferencing**

⇒ Arizona State University (ASU) formed a second campus and was immediately faced with need to hold cabinet meetings with staff in both locations. The solution was to acquire a modular PictureTel 4000 viedoconferencing system for each campus location. This approach was so cost-effective in terms of traveling and time that a PictureTel M-8000 Bridge was added to the system and now the three state universities in Arizona hold all of their Council of Presidents meetings via videoconferencing.

• **Broadcast Video**

Another goal of The New School in NYC is to become an "information provider," by becoming a producer of programming for delivery by common television carriers, such as the Public Broadcasting System. They are also exploring opportunities to exploit the emerging "video on demand" technology through partnerships with telephone and TV cable companies.

• **Two-Way, Interactive Video**

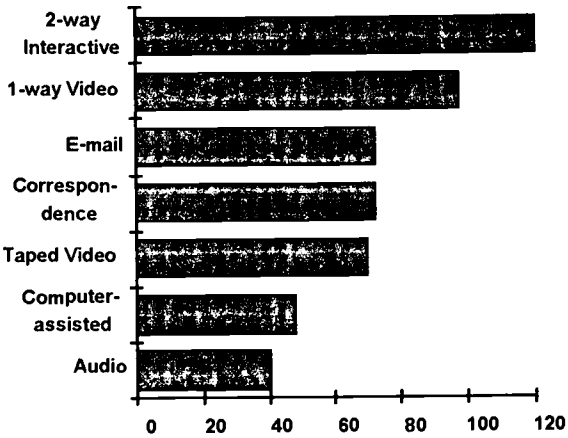
The State of Georgia has made an executive decision to fund 100 Compression Laboratories, Inc. (CLI) Rollabout systems for education in 1994. At a cost of about $50,000 each, these rollabouts will be part of an even larger program of video technology for distance education. By 1995, the State will have 500 such distance learning sites. The educational plan to use this technology is yet to be developed, but the Governor wants to be sure the infrastructure is in place to support video-based learning throughout the State.

From this point on in the paper, the data from the survey will be integrated into the text by referring to the it as "***Survey Results***."

Survey Results:

Somewhat surprisingly, the survey found that the dominant technology for the delivery of distance education was ***two-way, interactive TV,*** as reported by 120 campuses, with one-way TV a close second with 98 colleges and universities. E-mail and correspondence rounded out the top four with about 75 responses each.

Technology for Delivery
(Multiple Answers)



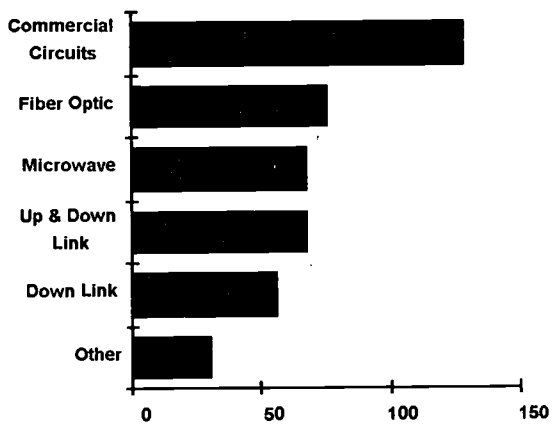
TRANSMISSION METHODS

An integral component of the technology used for the delivery of distance education is the "how." By this it is meant, by what technology with the materials be transmitted.

Survey Results:

The colleges and universities involved in distance education validated that they use many methods to deliver the "signal." And, interestingly enough, there was a dominant response.

Transmission Methods



Regardless of whether you call it "land lines," "commercial circuits," or "the phone company," the vast majority of colleges and universities are using the public telephone system to deliver distance education. Again, the option allowed for multiple answers, but 128 our of 160 respondents indicated that they used commercial circuits or land lines to transmit their programs.

The next most popular transmission medium was listed as fiber optics at 76 campuses. The confusion that might have come from this answer is that we do not know if it is fiber on the campus or the respondent's belief that most commercial circuits are now fiber, at some point is

the system. So, one might add these two together as a single dominant medium. At any rate, we are doing a lot of "earth" transmitting and using microwave as second (67 campuses).

REPORTING RELATIONSHIPS

Another major issue in the establishment and implementation of distance education programs is where the unit or function reports within the organization. Many would point out that effective programs are more a result of ***developing networks of relationships*** than on equipment.

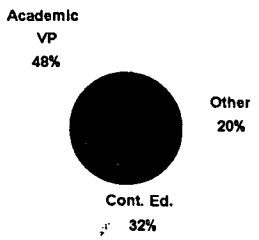
Another lesson for success teaches us that leaders at the highest levels of the organization are involved and success is more likely if visible support comes from the Prez. The University of Nebraska at Lincoln developed what is now known as Nebraska CorpNet with a chancellor pushing from the top down through the vice chancellor for academic affairs, and thence to the dean of engineering. CorpNet provided on-site training for business and industry using live broadcast TV.

Yet, the bottom line is that the unit must report somewhere. Since presidents are busy people, it is normal to place the unit within one of the operating units. Again, the higher in the organization the better. So, what's up?

Survey Results:

Where units report within organizations is often an indicator of support and importance to the mission of the college or university. Thus, the campuses were asked where distance learning reported within their organization. Almost half (***48 %***) said that it reported to the ***Academic VP/Provost*** and the other large vote (***32 %***) went to the head of ***Continuing Education***. The remaining 20 percent were largely indicating that the program reported to their academic unit, department, school, or college.

Reporting Relationships



STAFF COMPENSATION

Providing appropriate compensation for the faculty and staff in recognition for additional effort and gains in productivity has always and will continue to be a challenge in terms of fairness, in both the short and long run. As colleges and universities move into various new teaching modes, whether at a distance or not, it would be ideal if the issue of changes in compensation packages would not need to be addressed until new models can be tested and refined. Experience has demonstrated that once "bonus" or overload programs are begun, it is difficult to modify them, especially in a downward direction.

Survey Results:

Another issue concerning the faculty role in distance education programs is that of visiting the remote sites. In those cases where the instructor is "beamed" out via a video signal, is the faculty member obliged to go out an visit the students, person-to-person? Happily, it was reported that ***70*** percent of the institutions reported that main campus instructors ***visited the distance learning centers***.

LIBRARY SUPPORT

Effective distance learning often suggests that innovative consideration has been given to several forms of student and academic support, such as the library, and provide staff resources and facilities to make the remote learning site comparable to a normal campus experience.

The library staff should be working to expand its distance learning programs. For example,

⇒ To provide immediate response to requests for articles, it might be necessary to cease the lending of the serials collection to "Reference Only."

⇒ More of the collection might have to have duplicate copies which might reduce the range of materials otherwise purchased.

⇒ Assuming distance learning students will have access to the on-line catalog, additional resources would be needed to provide them materials by fax, mail, or e-mail. A similar financial impact would be felt from the use of commercial document supply services, such as Uncover.

Like other forms of "student support," some consideration should be given to the identification of staff resources to make the remote learning site comparable to the normal campus experience. At remote sights, what might be needed is a jack-of-all-trades type of individual who would be capable of handling library, computer, communications, and student services support. But, perhaps that is expecting too much from one individual. It might be more realistic to identify an *ombudsman*-type of individual who would know whom to contact back at the main campus to address particular faculty and student needs. The goal in all of this is to assure that the "distant campus" gives every indication of being the same as the main campus.

Survey Results:

Of those institutions reporting distance learning programs, ***74 percent*** said that they provided library support services to their students who were remote from the main campus.

OTHER ISSUES--LARGE AND SMALL

In the process of assembling the survey, several issues came to mind and were included in the final instrument that went out over the Internet. These results have been brought together as a summary of interesting issues.

Tuition and Fees. The perception of many is that the student must bear the financial burden for bringing education to them at remote sites. Yet, when asked if the tuition/fees are the same for distance learning as regular, on-campus courses, ***90*** percent said that they were the ***same*** or equaled to those paid by on-campus students. Of those who said that they were higher, the average represented an 11 percent higher tuition or fee.

Just Part of the Regular Academic Program. For 52 % of the campuses, distance learning is a regular part of its regular academic course offerings.

It's Old Hat!. One has the misconception that everybody has been doing this distance education thing for years. Yet, the reality is that the technology, need, and interest in all coming together within the 1990s for it to become a popular thing for higher education to do. In fact, the majority (61 %) of the respondents said that their distance learning program had been in operation ***less than 5 years***.

Part of a State-wide System. All of us like to have company. This is especially true with new technology and educational programs. So, it is not surprising to learn that 52 % of the campus in the survey indicated that their program was part of a state-wide system or network.

Keeping-up With the Others. In 76 % of the campuses, it was felt that the distance students fared as well as the campus students.

CLOSING THOUGHTS

As a closing to this discussion about distance learning, it might be interesting to record some of the thoughts of others as a means of reminding ourselves about some issues and concerns about distance learning.

The California State University formed a system-wide commission to examine the role of emerging technologies as a means of addressing the three concerns that dominate virtually all discussions of higher education in this decade--***student access***, ***academic quality***, and ***fiscal efficiency***.[5] The Commission reached several interesting observations:

- *Teaching and learning in the information age will be **less print-oriented** and classroom-bound than ever before.*
- *It will need to be **less labor-intensive** and more portable and modular in formats and delivery.*
- *The **home** and the **workplace** may become the classrooms of tomorrow.*
- *Instructional and support services will be based on the **convenience** of the consumers rather than that of campus constituencies.*
- *Education that is truly **learner-centered** ought to be delivered directly to the individual at a time and in a place determined by the learner.*
- *The recent "**marriage**" of computing and various forms of telecommunications can be expected to increase the scope and pace of technological innovation almost beyond imagination.*
- *Most estimates suggest that the technical means for integrating the two dimensions of non-traditional instruction--**delivery and format**--are only a few years away.*[6]

[5] Stephen L. Daigle & Patricia M. Cuocco, "Alternative Educational Delivery," CAUSE Exchange Library, CNC9238, December 1992, p. 1.
[6] Ibid., pp. 2-9.

REENGINEERING ADMINISTRATIVE PARTNERSHIPS

Susan Cover
Joseph DiMartile

University of Delaware
Newark, DE

ABSTRACT

In a renovated research building, Delaware's student services have been reengineered. Students no longer travel the campus in search of service. The functions of billing, collection, cashier, registrar, dining services, financial aid, ID card, parking, and long distance telephone service have been merged in a partnership of process and technology, and located in a single building.

The Student Services Building follows a "branch bank" model with a large lobby where self-service technologies enable students to perform routine business; providing easy access to transcripts, grades, schedules, financial aid and billing information. An open counter is staffed by "generalists" from several campus units who have been cross-trained and provided technologies to enable them to deliver a variety of services.

This successful merger of business units was facilitated by the application of appropriate technology and has resulted in staff reduction, cost containment, and improved customer service and satisfaction.

REENGINEERING ADMINISTRATIVE PARTNERSHIPS

Background

The decade of the 1990s presents a unique set of problems and challenges for colleges and universities. It is a time of shrinking budgets offset by demands for improved and expanded services. Institutions face keen competition to attract and enroll qualified students. Once enrolled, students and their parents, faced with seemingly endless increases in costs, scrutinize more than ever how their tuition dollars are spent. The current climate demands that we spend these dollars wisely, not only to instruct and educate our students, but to build positive, lasting relationships with our alumni-to-be.

Colleges and universities have mobilized to meet these challenges by initiating programs, some campus wide, that employ management methods now in vogue. Total quality management and process reengineering programs, though they may in themselves be old methods with new labels, represent sincere efforts to improve the way we do business. Invariably, efforts involve information technology resources and invoke the power of these resources to solve problems, streamline processes, enhance instruction and improve service to students.

This paper will provide a look at one approach to the challenge, that of the University of Delaware. As a case study, this paper will focus on the specific problem of improving student services in the face of the 90s dilemma of greater demand on fewer staff and fewer dollars. It is an approach that utilized elements of process reengineering, creation of administrative partnerships among many student service units and the judicious application of the University's investment in information technology.

Institutional Objective: Improve Student Services; "Think of Yourself as a Student".

To begin the decade, the University of Delaware formulated its short and long range plans in a campus wide effort called "Project Vision". A central theme and strategic goal of the plan is an enriched undergraduate experience, not just in the classroom but in every aspect of campus life. In 1990, as he assumed the presidency of the University, Dr. David Roselle urged deans, directors and managers to "think of yourself as a student" while implementing Project Vision plans in academic and administrative units. For directors and managers of administrative units, this meant a close examination of administrative services from the students' perspective and a complete reevaluation of how we conduct business with our primary customers.

While Project Vision implementation began to take shape in the Fall of 1990, the University had just completed a major conversion of hardware and software systems, including migration to a fully integrated student system. From a system perspective, administrative units had acquired a significant resource which could and should be used to its maximum to improve student services. SCT's IA-Plus Student Information system (SIS Plus) is a fully integrated system for demographic information, student records, financial aid, housing, billing and collections, and admissions data. The system is run on an IBM 3090 600E under MVS CICS. The underlying DBMS is ADABAS and access to ADABAS is through direct calls in COBOL. The system runs very efficiently and will return a 26 page internal transcript or a complex degree audit to the screen in less than 6 seconds. Staff in those units were no longer limited in their access to information and, through participation on the Student Information System Task Force, had gained an understanding of the needs and interdependencies of their colleagues in other administrative areas. An integrated student information system and a new, more collegial attitude among staff provided a foundation on which better, more efficient student services could be built.

One long standing issue that the Student Services Planning Group felt needed to be addressed had to do with the physical condition and location of the offices responsible for student services. Administrative units were scattered across the campus so that it could take several days for a student to find and visit them all. The offices were not well configured for student traffic and not well arranged given the new technological tools available. The Registrar's Office, for example, was designed and constructed when the University's student population was only 5,000, one forth of what it is today and the Cashier's Office was located in a basement off a long, narrow corridor that allowed for only two cashiering stations. Neither office was connected to the campus network. To accomplish our institutional objective of improving administrative services, it was essential that this problem be addressed.

A Central Student Services Facility

In the summer of 1991, a small but centrally located building of approximately 11,400 square feet of assignable space became available. The space had previously been used as a research laboratory but it was thought that it could be renovated and serve as a central facility for student services. A preliminary study concluded that the idea was feasible provided the interior of the building was gutted and renovated in its entirety. The Student Services Planning Group was then assigned the task of designing the interior of the building around the services that would be dispensed there and support the service delivery with every available technological tool.

The prospect of having a facility designed specifically for student administrative services was both an opportunity and a challenge. The Planning Group knew from the start that the facility would serve the University into the distant future and the design was critical to its long term utility. Of necessity, the first task of the Planning Group was to set very specific goals and objectives (Table 1) for the new facility. These provided a useful structure against which a reengineered process or design idea could be tested.

TABLE 1

STUDENT SERVICES BUILDING
GOALS AND OBJECTIVES

Goal: Quality and Efficient Service to Students	
Objective:	• Change Academic Policies • Question Past Practices • Streamline Procedures • Become "Student Friendly" • Use Concept of Being Serviced by "Zero or One" Person.
Goal: Teamwork Among Administrative Units	
Objective:	• Foster Cooperation Among Units • Focus on Institution Goals over Individual Unit Concerns • Be Willing to Reorganize When Necessary • Be Willing to Cross Train Staff
Goal: Apply Technology to Fullest Advantage	
Objective:	• Use the Campus Fiber Option Network • Take Full Advantage of the Data Base Environment and Its Integration • Ubiquitous Access

With a set of goals and objectives in hand, the Planning Group's next task was to decide which administrative services were to be located in the new facility and how they would be structured. Since the facility when renovated could provide only 11,400 square feet of assignable space, it was not large

enough to accommodate all personnel from each service unit. Services and staff were carefully selected and targeted for permanent location in the new facility based on the frequency and number of students served. For example, the registration and cashier functions typically deal with each student in each enrollment period while others provide services on a less frequent basis. Concurrently, policies and procedures pertaining to student services were evaluated, and where necessary, changed to fit the student service goals. Staff from service units were selected on the basis of their frequency of student contact and a number of jobs were redefined, clustering the student service tasks in selected positions and distinguishing them from processing or "back room" tasks. In the end, the new facility houses on a permanent basis the Cashier and Accounts Receivable operations in their entirety, portions of the Registrar's and Financial Aid Office services, Dining Services, Student Telephone Services. In addition, provisions were made in the building design to accommodate activities of other units, specifically Public Safety, Housing and Student Life, on a temporary basis.

The Banking Industry Model

The process of planning the new facility included contacts with other colleges and universities and with industry in an attempt to find a model similar to what we were trying to achieve. Contacts and visits with other colleges produced some new ideas but a comprehensive services facility in which a student could attend to a variety of administrative tasks in a single stop seemed to be non-existent. A model, however, did exist in the business world, specifically in the financial industry's branch banks. The branch bank model fit the student service objectives in many ways; service was quick and efficient, the customer could be selective in how he or she dealt with the bank i.e. by phone, by mail, at an ATM or in person, and financial

Table 2

BANKING INDUSTRY MODEL APPLIED TO STUDENT SERVICES

TRANSACTION TYPES

20%	60%	20%
SELF HELP	ROUTINE STUDENT BUSINESS AND INFORMATION ASSISTANCE	SPECIALIZED ASSISTANCE
Closed Circuit TV: Post specific student-related information from all areas. Information Packets: Drop Boxes: Registration Fee Payment Kiosks Access to Student Information UDiscover	Generalist: Respond to information requests from all students; deliver routine services. Direct students to appropriate source of help. Routine Business: ID Cards Cashiers Financial Aid Registrar Public Safety Dining & Debit Housing Long Distance Phone Service Student Paychecks Event Tickets	Specialist: Provides assistance that requires attention above the routine business transactions. Financial Aid Registrar Accounts Receivable Dining Services

institutions seemed to be on the forefront of using technology to support customer service operations. Applying the branch bank model to the planned student services building, parallels could be drawn quite easily. For

example, the self service and ubiquitous access objectives could be served well by ATM type machines or by Interactive Voice Response devices. The bank model served too as a guide for staffing the facility and distinguishing the routine tasks accomplished by someone generally trained (bank teller) from those with special training in a specific function (loan officer). The Planning Group adopted this generalist/specialist model (Table 2) and devised the plan for the new facility accordingly.

Technological Support

Technology to support the new facility involved purchasing new workstations and utilizing software with attention focused on getting the most service for the fewest dollars. Existing software was modified to provide new functionality and, when necessary, new software was purchased and customized.

Each staff person in the Student Services Building has a personal computer (PC) work station. Additionally, 6 PCs are located at the Service Desk counter and 5 at the Cashiers counter. The PCs were purchased in the summer of 1992 and are 386SX machines costing about $1500 each. At the Service Counter the PCs are equipped with numeric key pads for services that require a PIN. At the Cashiers counter the PCs are equipped with a journal printer for the register tape and an OCR scanner for processing bill and student loan forms to support the additional functions of a Cashiering operation. All PCs came installed with Microsoft Windows 3.1.

Microsoft Windows provides for multiple sessions resulting in a quicker response to a student's request. The Cashiers PCs always have one session running the Remittance Processing system, a DOS application, and another session running a terminal emulation session to SIS Plus. Windows supplies the means to switch from one application to another quickly and easily.

Another group of PCs in the Student Services Building are the "kiosks" for self-service student access. The kiosks are also standard $1500 PCs. The CPUs are stored in a locked cabinet and some keys on the keyboard have been physically disabled to prevent students from re-booting the PCs. A staff person logs the kiosks on to the IBM MVS Student Information system each day. The kiosk application was developed by modifying SIS Plus using MIS staff. New screens were developed and existing COBOL programs modified to interface to the new screens. Functionally, a student enters his/her student identification number (SID) and a personal identification number (PIN) on the authorization screen and then can view an unofficial transcript, grade report and class schedule for current and previous terms, financial aid information, billing information, and address information. The student name and number never appears on any kiosk screen to protect the student who walks away from the kiosk without returning it to the authorization screen. The kiosk application is character based and is very popular with the students.

Another self-service PC for students provides access to "U-Discover", the campus gopher client for world wide access. This service includes the full schedule of classes for future terms weeks before the booklet is published; lists of open courses updated nightly and the final exam schedule. Students can also read through listings of apartments to rent, job opportunities, and general information. U-Discover also provides access to the same personal data available through the kiosks. A menu option labeled SIS+ Personal Access uses gopher software modified in-house to provide for encrypted authentication. When that menu option is selected, the student is prompted for SID and PIN. Then an unofficial transcript, grade reports and class schedules, financial aid and billing information can be viewed. Students can also submit a change of address request using SIS+ Personal Access. The current address information is displayed and the student types over it to make a change. The change is sent as a mail message to a staff

person in the Registrars Office who reviews or corrects it before mailing it to an application that updates the Student Information System address segment. This eliminates the keying of hundreds of address changes each term by the Registrars Office staff.

The Cashiering software was purchased from CORE Business Technologies of East Providence Rhode Island. The software is designed to be customized with regard to screen layout and validation processing. The customization is written in C++ and can be maintained in-house or by CORE. Initially, all transactions were transferred using FTP to the IBM mainframe after the office closed each day. In the fall of 1994, the Cashier's Remittance Processing system was enhanced to interface real-time to the HP Unix ID card system for posting of flexible spending (FLEX) account deposits. This interface is written in C++ and sends a TCP/IP packet across the network to a server running on the HP machine. The server was written by Harco Industries of Phoenix Arizona. The application will set up a new FLEX account if the student does not already have one or will post a deposit to an existing account. Prior to this enhancements students were told that FLEX account deposits would be available "tomorrow". Now they are told the money is available immediately.

Also in the fall of 1994, an ID card production system was purchased to capture a digital image of a student and print an ID card in full color on white PVC plastic. The system was purchased from Goddard Technologies and was customized by Goddard to interface to the Harco ID database that controls student privileges and access on campus. The Harco Industries server is also used in this application to implement the real time interface. The images are stored as .JPG files on a SUN unix server so they can be used in other applications. It is no longer necessary to take a new picture of the student to replace a lost ID card resulting in a cost savings. However, some students consider this a drawback. We recently learned that some students lose their cards intentionally because they do not like the picture.

An imaging project currently under development will replace an obsolete microfilm reader for transcripts that pre-date our on-line system. The microfilm reels were converted to .TIF files on compact disk. The paper indexes were keyed by data entry staff and loaded into an ADABAS file. A client server application was developed in C++ to provide an index search and image retrieval system. It interfaces to an image viewer developed for this application using Image Basic from Diamond Head Software, Inc. The transcripts can be viewed and printed for mailing. The quality is better than that printed from microfilm and the Student Services staff saves time because index and images are on-line. Once the system is operational it will be made available to Dean's offices and the Alumni Office reducing the dependency of these offices on the Registrars Office for transcripts not available in the Student Information System (pre-1972).

Outreach Efforts

The Student Services Building at the University of Delaware opened in August of 1992 as the center piece of the institutions efforts to improve student services. It has been in operation two full years and has become a hub of student activity on campus. It has also spawned a number of services that are now provided outside the confines of the building. They are a direct outgrowth of the planning process and provide a useful complement to the central facility.

Interactive Voice Response applications (IVR) were developed to expand student services beyond the Student Services Building. The IVR system is from Perception Technology and the IVR application development tool from Touchtalk, Inc. Dubbed UDPHONE, the first IVR application was developed for

registration. The application uses a component of SCT's IA-PLUS Student Information System. Grade reporting was implemented the following year also using a component of SCT's software. Two other student oriented IVR applications are UD1-BOOK for renewing library books over the phone and UD1-CARD that interfaces to the IBM mainframe and the HP Unix mainframe for changing personal ID numbers, suspending a lost or stolen card, checking FLEX account balance, dining points balance, and remaining meals.

The development of a secure gopher client for accessing personal student information system data provided us with the means to distribute access to that data across campus. In the fall of 1993 all residence halls were connected to the campus network. Students may purchase an Ethernet connection for their computer in the residence hall and have access to their personal data. The secure gopher client is distributed initially on diskette to students. Later upgrades can be downloaded from a software library available on a gopher server. This semester over 600 students have requested Ethernet connections up 300% from last year when it was first available. For students not in residence halls, the secure gopher client has been installed in all public computing sites on campus and on PCs in the Student Center and several Dean's offices.

Results, Measurable and Perceived

The University of Delaware chose to deal with the challenge of improving student services in two distinct but related ways: by creating an environment in which student services are dispensed from a central facility and by using to the fullest extent possible the University's investment in computing technology. The results are measurable by the simultaneous reduction of staff and budgets in most of the units involved and the increase in productivity. With better access to a broader spectrum of information, staff are better prepared to serve students. The perception among students is that doing business with the University is much easier now. They can very quickly and conveniently dispense with the administrative necessities of enrolling in college. Perhaps the greatest testimony to the success of this effort at the University of Delaware is an editorial which appeared in student newspaper and read in part:

> **"The end of another school year... 'The Review' spends its time reevaluating the past year's memorable events, judging the highs and lows... Cheers go to the new Student Services Building. Finally, a student can take care of a multiplicity of needs, at one time!"--From 'The Review', Friday, May 21, 1993.**

"THE CONSULTANCY: A TEAM APPROACH TO DEVELOPING PARTNERSHIPS WITH IT CUSTOMERS"

Jan A. Baltzer, Director of Computing & Communications
Pat Honzay, Coordinator of Business Renewal™ Activities
Maricopa Community Colleges
Phoenix, Arizona

ABSTRACT

One of the critical challenges facing any IT organization is the alignment of its services and technology applications with the overall goals and objectives of the institution. This alignment requires in-depth understanding of the customer's needs and an unbiased diagnosis of how information technologies can or cannot be used to meet these needs. In the fall of 1993, the Information Technology Services division of the Maricopa Community Colleges, created a group called "The Consultancy Team" with the stated purpose of forming partnerships with customer departments to provide a business approach to problem resolution rather than a technical approach. Over the last year, the Consultancy Team approach has evolved into broader based cross-functional teams as Maricopa has begun its APOLLO Project, a two-year partnership project between Maricopa and the Oracle Corporation for the replacement of all administrative systems at Maricopa and the joint development of a new Learner-Centered System. This session will focus on the environmental issues that created a need for the consultancy approach to partnering with customer groups, and will explain the evolution of the Consultancy Team from its original configuration to its current state, giving examples of how The Consultancy works with customer groups in both continuous improvement and business process reengineering efforts.

"THE CONSULTANCY: A TEAM APPROACH TO DEVELOPING PARTNERSHIPS WITH IT CUSTOMERS"

The Environment

Current literature is filled with references to changes that are occurring in the management structures of today's major corporations and institutions. In their book, *The Challenge of Organizational Change,* Rosabeth Moss Kanter, Barry Stein and Todd Jick give this opinion:

> "A universal model for organizations is developing, especially for large organizations, as a result of the changes we are seeing in the external environment. This model describes more flexible organizations, adaptable to change, with relatively few levels of formal hierarchy and loose boundaries among functions and units, sensitive and responsive to the environment; concerned with stakeholders of all sorts--employees, communities, customers, suppliers and shareholders. These organizations empower people to take action and be entrepreneurial, reward them for contributions and help them gain in skill and 'employability.'" (1)

It is unfortunate, that this description of the "new organization" of the 90's does not describe very many of our higher education information technology (IT) organizations.

Every IT organization in higher education is facing three major organizational issues as we move into the middle of the 90's. These issues are: (1) the need to reassess the organizational structure of the IT department; (2) the need to reassess how IT departments interact with our customers; and (3) the need to remove boundaries within the IT organization, itself, between the IT organization and other units within the institution, and between the institution and external groups.

The Need to Reassess the Organizational Structure of the IT Department. IT departments need to reassess their organizational structures because it just isn't "business as usual" anymore. The move of computing power out of the computer center and into the hands of the end users has changed the role that the central IT organization is asked to play. The ways in which we have vertically organized IT staff around specific technologies or applications, is not "in sync" with the movement of our institutions toward Total Quality Management (TQM) and the accompanying emphasis on teams and teamwork. The demand for IT specialists, while at the same time, the need for generalists to deal with business-related issues, is inconsistent with the ways we

have traditionally staffed our IT departments. And, finally, the old job titles and competency sets that were the mainstay of the IT department of the 70's and 80's will no longer suffice. Our IT professionals are being called upon to radically change their skill sets in both the technical as well as nontechnical areas. New job titles and new competency sets call for new organizational structures.

The Need To Reassess How IT Departments Interact With Our Customers. There are two major problems with the way in which IT organizations have typically related to our "customers." First, over the years, we in IT organizations have convinced ourselves that OUR customers are the business offices, the human resources departments, the admissions departments, or, in the case of academic computing, the faculty. We have lulled ourselves into believing that if we take care of OUR customers, they will take care of THEIR customers. This luxury of allowing ourselves to be one or two steps removed from a major portion of our constituencies cannot continue.

Secondly, the way in which we listen to, communicate with, and serve our more traditional customers within the institution--the human resources and business offices, the student services and admissions department, the faculty, etc.--must change. We must recognize that the leadership and sponsorship role of information technology initiatives is shifting away from the IT organization and into the user community, and that identification of the real owners and customers of technology-based systems must be recognized. We must focus more on the customer/owners of the technology systems rather than on the technology itself.

The Need To Remove Boundaries. In higher education institutions, separate internal organizations have historically been established to deal with academic vs. administrative computing, or voice vs. data communications, or audio visual services (i.e., video) vs. computing. In the past three to five years, however, technology developments that merge voice technologies with computing such as touch tone registration or computer-based facsimile, not to mention the common network infrastructure needs of voice and data communications, have blurred the lines of responsibility for these technologies. Technology advances in the transmission of digital video across local and wide area networks have resulted in new applications for desktop video conferencing and multi-media instructional delivery. Networks and the hardware/software connected to them are "neutral" and can/should be used for both academic and administrative purposes. Convergence of technologies and the accompanying growth of end-user computing are forcing the IT organization to reassess how it works, moving more to a cross-functional

team approach than the traditional, "dedicated" technologist approach.

The Consultancy Team

The Maricopa Community Colleges have definitely felt the impact of all three major IT organizational issues. Added to these pressures have been the pressures of antiquated administrative applications, increasing user demands, changing technology. This pressure reached its peak in the fall of 1992, following the defeat of a major bond referendum which had been designed to provide Maricopa with the resources to upgrade its infrastructure, administrative applications, and desktop technology. There was no money; the picture was grim; and the need to provide innovative solutions to customer problems had never been greater.

The answer that was devised to meet these tremendous needs was the development of an internal IT group called "The Consultancy Team." The goals of "The Consultancy Team" were:

1) to link IT applications to business strategies,
2) to provide unbiased diagnosis of business information needs,
3) to provide a business-oriented approach to problem solving rather than a technology-oriented approach, and
4) to deal with the need for both specialists and generalists in meeting customer needs.

In its original form, The Consultancy Team consisted of a strategic consultant, a technical consultant, a training consultant, and a quality facilitator. The role of each of these individuals was as follows:

Strategic Consultant. The strategic consultant worked with customer groups to identify business problems and to access the appropriate technologists within the IT organization to provide solutions. The strategic consultant convened the team and created the agenda for the meetings. This individual was also responsible for documenting the process through team notes and flow charting tools.

Technical consultant. The technical consultant provided initial technical support for the strategic consultant and assisted in identifying and documenting the technical expertise that might be required for the business solution.

Training consultant. The training consultant assisted in the development of training programs, job aids, etc. in support of identified business solutions

Quality Facilitator. The quality facilitator facilitated group discussions and assisted the strategic consultant in group problem-solving analysis and activities.

When a business problem area was identified, the consultancy team worked with a cross-functional team to identify the "true" business problem and to identify possible alternative solutions. The key members of the cross-functional team were the business area experts, individuals who either worked in the business area on a day-to-day basis or were impacted by the business area. In addition, the team included one or more of the following "types" of individuals: systems programmer, network professional, ad hoc reporting specialist, and possible vendor partners.

The initial work of the team process utilized a continuous improvement approach. The team documented the existing processes and sought opportunities for improvements. The process of questioning and analyzing the business area for this level of detail provided an opportunity for the team to see areas of redundancy or other inefficiencies which could be improved. The potential solutions were not always technical solution but also included modifications of the user's processes.

The APOLLO Project

In July of 1994, the Maricopa Community Colleges signed a contract with Oracle Corporation to replace all of our administrative systems including human resources, financial records, student information and electronic mail.

One component of the contract includes reengineering the current processes which are traditionally considered to be part of a Student Information System. Axiom is the subcontractor providing the consulting services for the reengineering effort using a methodology that they call Business Renewal™. As a result of the Oracle contract and the commitment to utilize Axiom's Business Renewal™ methodology, Maricopa has expanded it's team approach to involve additional individuals from within IT department and from the ten Maricopa colleges.

Applying the knowledge gained from The Consultancy Team, the APOLLO project teams have been expanded to include the following roles: a customer project coordinator paired with an IT coordinator, business area experts with cross-functional representation, a renewal analyst (our prior strategic consultant), a trainer/recorder, a technology lead, an operations lead, a database administrator, a data administrator, a designer/developer and a network administrator. Each individual on the team has a role to play in addition to his/her responsibilities as a team member.

The first phase of the APOLLO project included the establishment of four early victory teams. These early victory teams provided the opportunity for the team members to "practice" their roles before proceeding to work on the major project components of APOLLO, particularly the expansive process of rethinking the ways we serve learners and the development of the new Learner-Centered System (LCS) - formerly referred to as Student Information System or SIS.

During the Spring semester of 1995, the LCS Renewal project teams will be identified and will begin documenting the "to be" activities for our future "Learner-Centered System". The activities will be analyzed for value added based on cost of the innovation as well as time spent on task. The process will also review the organizational structure required for the "to be" process and the impact it will have on personnel. By Fall semester, 1995, the design and development of the new Learner-Centered System will begin and lead to implementation by Winter of 1996.

Conclusion

Through our research we have found that there is no "cookbook" approach to the process of using cross-functional teams to better serve our IT customers. Each of our teams is taking the tools and techniques we have learned and is applying them in ways appropriate for the scope of the team. We have learned that the team concept is an effective way of analyzing and documenting the business area processes before reaching the conclusion of automating the process. The initial teams have been a learning experience for all of the participants. The knowledge gained will be applied to future teams in the form of modification and clarification of team roles and team processes. The end result, we believe, will lead to a solution that is customer focused, with joint support from both the customer community and the IT organization.

Footnotes

1. Rosabeth Moss Kanter, Barry Stein and Todd Jick, *The Challenge of Organizational Change* (New York: The Free Press, 1992), p. 3.

Reengineering for the 13th Generation

Louise Lonabocker
Associate Dean, Enrollment Management and University Registrar
Boston College
Chestnut Hill, MA 02167
louise@bcvms.bc.edu

John Springfield
MIS Technical Support Programmer
Boston College
Chestnut Hill, MA 02167
spring@bcvmcms.bc.edu

Abstract

America's 13th generation, born 1961-1981, is the impatient, quick-and-dirty generation. They play video games that stress action, acquisition and one-on-one heroism; they have sound bite attention spans; and they like short term tasks with observable results. For them, life is fast, complex and entertaining. They use programmable computers, VCRs, and telephones, have access to 24-hour banking and cable TV, and transact business with cards instead of cash.

This paper will describe the development of partnerships among information technology and administrative and academic departments at Boston College to deliver information and service to this self-sufficient generation in a fast, familiar, intuitive way. Business practices and information systems have been reengineered to provide new ways of presenting, transmitting and processing information; and office procedures now offer one-stop service that automatically routes information throughout the university for simultaneous processing.

Today's Students - America's 13th Generation

This generation of students is America's most ethnically, culturally, and economically diverse. They follow the GI generation, born at the turn of the century; the silent generation, born 1925-1942; and the well-known boom generation, born 1943-1960. Instinctively, generations have provided for the next; but with the 13ers, things began to change. Today 80 percent of college students work an average of 26 hours a week. Before the first GIs hit their 65th birthday in the mid-60s, the elderly age bracket was the nation's most poverty-prone; in 1975, this distinction jumped to the 13er child age bracket, where it has remained.

America has spent the entire 13er life cycle favoring consumption over investment, living beyond current income, and raiding the future to make up the difference. Today 87 percent of college students have a credit or charge card or have access to one used by their parents. Two-thirds of college students participating in a national survey had experienced at least one of the factors that demonstrate poor money management or a lack of knowledge about money and spending including bounced checks, credit card balances that were at what they described as at "an uncomfortable level", and late payment of bills.

In the 1940s, the very thought of making babies propelled young soldiers and Rosie-the-Riveters to victory over fascism; in the 1950s, baby-making was just standard suburban behavior; by the 1960s, the very thought drove young couples to doctors to prevent it. A child's world was unerringly sunny in the 50s, overshadowed by adult arguments in the 60s, scarred by family chaos in the 70s. In the 50s, nearly every movie or TV show was fit for kids to watch; come the 60s it was touch and go; come the 70s, forget it. The quality of the new teacher recruits remained high through the 50s, became suspect in the draft-pressured 60s and sank (along with teacher salaries) through the 70s. Adolescent sexual discovery meant free love in 1970, herpes in 1980, AIDS in 1990 (Howe and Strauss, 1993).

In the 1960s, birthing became unfashionable, and did not regain its status until the early 1980s when *Baby on Board* signs first appeared and social trends started shifting away from neglect and negativism toward protection and support. Divorce rates receded somewhat, teacher salaries gained ground, and a flurry of new books chastised parents for having treated kids so poorly in the 1970s.

Many of today's teens have grown up fending for themselves. Between marital splits and working parents, teenagers are responsible for far more decisions than other postwar generations, and they're being asked to take on more adult tasks. They shop for themselves, do their own laundry, and get dinner for themselves.

The 13ers are often thought of as directionless slackers, but they have developed skills in areas their elders don't know as well and are at times afraid to learn: telecommunications and computer technology. With their time for exploration, teens spend hours searching through the vast online domain of Internet. America Online features Compton's Electronic Encyclopedia, DC Comics and M-TV news. Prodigy also has an encyclopedia, and downloadable games as well as games that can be played online, bulletin boards and live chats. Internet news groups include a

vast array of information about computers, travel and recreation. Electronic mail allows students to communicate with friends in other parts of the country and the world.

Baby boomers grew up shopping at downtown department stores and Woolworth's. Eating out was an infrequent treat at the local dairy bar, diner or restaurant. McDonald's and strip malls changed all that. In *Generation X* Doug Coupland points out it doesn't matter where you're from since everyone has the same stores in their malls. A walk through Siam Square in Bangkok will take you past Burger King, Kentucky Fried Chicken, TCBY Yogurt and a Hard Rock Cafe.

In the 1960s students leaving for college packed the family car with clothes, a typewriter and a hot pot. In the 90s nothing less than a Jeep Cherokee will do to transport the computers, cordless phones, VCRs, TVs, CD players, microwaves and other electronics necessary for civilized living. Teens call the shots on a broad range of purchases. Their necessities are our luxuries.

On college campuses mealtime once meant steam tables, mystery meats, a set menu and a snaking service line. Today the latest wave on campus is the food mall, which has moved west to east across the country. It's a mirror of the outside world where students use declining-balance electronic debit cards to graze at the same places they've eaten at for as long as many of them can remember. To the generation that cruised malls and hung out at fast-food joints, the food is reliable and familiar.

In the 1960s parents and their offspring collected green stamps. In the 90s, it's frequent flyer miles. Students can accumulate miles, scroll through and participate in various Internet news groups to plan their trips, communicate via e-mail with friends who reside in and around their destination, send a FAX to arrange accommodations and tours even in the remotest parts of the world, bring their cellular phone to call the park ranger if they get lost, and use their credit card when they run out of cash.

On college campuses students are members of an increasingly diverse society. The international student population has grown 30 percent over the past decade, more than half from Asia pursuing degrees in business, engineering, physical and computer sciences. In 1992-93 foreign students made up 22 percent of the student body at MIT and 15 percent at Harvard. Minority students account for 20 percent of the enrollment at four-year colleges and over 25 percent at two-year institutions.

Coupland talks about today's Global Teens, collegians who live their lives together. They shop, travel and squabble in packs. They're moderate in behavior, use no drugs, drink very little, enjoy good coffee, watch videos and eat popcorn. They love clothes and insist on the finest labels. They shop at the Gap, Limited, Structure, and Armani. They live at home. When they travel, they go together, and once they arrive, they make daily telephone calls to those who couldn't come. They will be part of the workforce in the technology-based global marketplace of the future.

The 13th generation is thought to be an apathetic and apolitical generation, weaned on Vietnam and Watergate, absent of heros. But they are active in community service for the

homeless, disadvantaged and abused, and having a young president and vice-president has reawakened a spirit of public service to a generation that was losing interest. They have grown up witnessing declines in economic opportunity, stable relationships, housing, safety and hope for the future. Now they want to help shape that future.

Reengineering the Process

13ers are frustrated by lines, bureaucracy and hassles. Wherever they see useless tangles or time-wasting processes, they look for a quick bypass. They're total quality consumers. Our goal in reengineering student systems has been to eliminate those useless tangles and time wasting processes.

Total Quality Management (TQM) theory encourages administrators to engage in systemic thinking about the constant improvement of all processes that deliver value to customers, and to organize work around the needs and preferences of those customers instead of within traditional departments. Walls are disappearing and students, staff and faculty are working together to design and deliver services in convenient, appropriate ways (Marchese, 1993).

Reengineering is another term used when basic assumptions about the way things are done are reexamined. The goal is to go beyond the automation of an existing process, and design systems that fit the needs of the customer. Reengineering encourages designers to use technology to do things that are not already being done, to recognize a powerful solution and then seek the problems it might solve. The aim should be to cross boundaries among offices, reduce inefficiencies and duplication of effort, locate decision points where the work is performed, and make use of appropriate technologies (Penrod and Dolence, 1991).

Data should be captured once at its source and then reside in the system for the benefit of all authorized users. Access and utilization strategies are essential to maximize information system abilities to achieve and maintain institutional health. Access implies that all individuals who need information have it available when they need it. Utilization implies that the system provides the information in a form clients can use and readily interpret.

At Boston College the Information Technology division has formed partnerships with administrative offices on campus to deliver service to students and staff across a variety of platforms including Consumer Transaction Terminals (CTTs), microcomputers with graphical user interfaces (GUIs), and touchtone telephones. The strategy is to capture data at the source, allow end-users to process their own transactions, and give employees comprehensive views of information that enable them to perform their work effectively. The first step toward distributed access came with the introduction of the *U-VIEW* system.

U-VIEW - Just like an ATM

In February 1989, students were given access to their records at an ATM-like Consumer Tranaction Terminal called U-VIEW. After inserting their ID card and Personal Identification Number (PIN), they could view and print their own academic, biographic, and financial

information. 13ers immediately understood the familiar interface, which was easy, fun and available after business hours.

Students since that time have used the menu-driven system to select transactions that display their class schedule, grades, grade point average, rank in class, final exam schedule, home and local address and telephone numbers, financial aid award, student account and vehicle registration. Using other transactions students see the status of their guaranteed student loan check; their advisor's name, office number and telephone extension; their registration appointment time; their library account; and their financial clearance status. Students can also request degree audits. To maximize the number of transactions processed, the system always features an item of the day, which is displayed as the first item on the first menu. For example, at the end of the semester "print grade report" is the item of the day.

Not only did the students benefit from U-VIEW, but the administrative offices noticed that students were not visiting them for mundane services anymore. When students did come to an office, they were prepared with a U-VIEW printout and knowledge of their status. Managers started shifting their staff orientation to in-depth customer service instead of data entry and dissemination. Reengineering was starting to make a difference.

There are now seven devices on campus, dedicated to providing fast, visual displays of a limited set of functions. The devices are convenient for a residential population, but they were not suitable for thought-provoking transactions like registration, and that's where the longest lines were. It was time to explore voice-response technology, which brought us to our next development: *U-DIAL.*

U-DIAL - No More Lines

In October, 1990 a touchtone, voice-response application for registration and drop/add called *U-DIAL* was added. The touchtone, voice-response system resembles systems developed at other institutions. Students processing registration by telephone enter their student ID number, their Personal Identification Number (PIN) and their registration access code. The registration access code is printed on the student's registration form, distributed to the student's advisor, and when the advisor releases the form, the student is clear to register.

U-DIAL allows students to add and/or drop courses, list their courses, and obtain the current status of a course. The system checks for time conflicts, corequisites, and restricted courses.

The real advantage of *U-DIAL* for students is the availability of the system from almost anywhere in the world and the chance to modify their schedules anytime after registration through the last day of drop/add. The telephone is an ideal medium for students, it's intuitive, requires no training, and suits their mobile lifestyle. There is, however, a limit to the amount of information that can reasonably be spoken, e.g. schedule of classes, and the type of information that can be captured, e.g. address changes.

Students needed something that allowed them to see the range of information available on U-VIEW, process the registration functions of U-DIAL, and complete additional transactions. This led to the development of U-VIEW Plus.

U-VIEW Plus - Seeing is Believing

One semester after the introduction of *U-DIAL*, *U-VIEW Plus*, a terminal-based student access system, was added. Using terminals, students can enter and view their entire schedule, simulate various scheduling options, search for open sections of courses, and display information about courses including titles, instructors and meeting times. "This is the most convenient way to register," said one senior. "No long lines and no busy phone!"

Directions for using *U-VIEW Plus* are printed in the registration publication, but students usually arrive at the terminal with no instructions, expecting the computer to lead them through the transactions. Now logon instructions are posted at each terminal, the menu displayed after logon shows available options, and each screen contains instructions for completing that transaction. All update and display screens are designed for minimal cursor movement by the student. The student just enters course index numbers and hits the enter key.

Users of *U-DIAL* and *U-VIEW Plus* rated them positively, but the majority of students were not convinced that *U-VIEW Plus* had advantages over *U-DIAL*. "The telephone is more convenient," said a sophomore management major. The terminal interface was not intuitive to a population unaccustomed to moving a cursor, hitting an enter key, typing commands like *done*, *save* and *quit*, or using a reset key to unfreeze a cursor. It took a graphical user interface designed on Macintosh computers to move the majority of the traffic from telephones to microcomputers.

U-VIEW Plus - Welcome to the Macintosh

The Boston College computer lab houses over 100 Macintosh micrcomputers, 20 DEC terminals and 20 IBM microcomputers. Most students who use a device to complete a class assignment or paper select a Macintosh. They're lost without a mouse. *U-VIEW Plus* for the Macintosh lets them use that mouse and familiar Macintosh icons to point-and-click their way through registration. The new interface is more intuitive; it denotes commands with pictures or icons and limits the amount of keystroking. "Hey, this is like channel surfing! I've never used a computer before and I was finished with registration in a few minutes," exclaimed one freshman 13er.

Despite having various levels of computer knowledge, students register with no training or written instruction. Upperclass orientation advisors and staff from the registrar's office assist new students during their registration session in the computing facility. While new students welcome the chance to ask questions and request help, upperclass students usually ignore the staff member on duty in favor of seeking help from peers at adjoining computers, which reassures us that our systems do not destroy community and communication.

Students who like to go it alone can click on the tutorial icon or the help icon. Few do. As they move through the registration process, additional information is provided. If a course entry generates an error message, a new icon appears and clicking on it brings up a help screen of error message definitions. Some errors generate an additional exclamation point icon and message, which helps the student resolve the error easily.

The highlight of the system is the course search and select option. By clicking on an icon of a magnifying glass, and entering a department prefix and number, groups of related courses are shown with current displays of course availability. Selecting a course is as easy as using the mouse to set the pointer on it, clicking, clicking next on the checkmark icon, and the student's schedule reappears on the screen with the new course.

With the introduction of the GUI, the traffic on *U-DIAL* stabilized, and the number of students using *U-VIEW Plus* quintupled. We learned that the more devices and platforms we offered, the more students used the system. And with the addition of Mail Drop for sending e-mail both on campus and over the Internet, the use of GUI's continues to grow.

The GUI was created with a front-end development product called "Both" by Connectivite. This tool allows the design of Macintosh-type objects and associated scripts which send both transaction names and the input required by existing mainframe applications. Communication between the Macintoshes and the IBM host is driven by the "Both" application through Avatar's Netway 2000 gateway.

In recent years more students are making use of a computer and a modem at home or in their dorm room to dial in to *U-VIEW Plus*, which means they are using the terminal interface rather than the GUI. The motivation to use it came when grades were displayed on *U-VIEW* and *U-VIEW Plus* as they were posted on *U-VIEW*. New students also seem more confident with the remote dial-in option, using it to register for classes if they are unable to come to an orientation session.

When the dorms are networked in September 1995, workstations sold in the campus Computer Store will be bundled to include the GUI. Additional functionality will be added to the system at that time. In the meantime we have begun to move further toward the paperless office by automating the completion, approval and routing of forms.

Electronic Forms - Nuke the Paper

Information traditionally flows between offices on paper forms. Some forms are notifications that require no approval, like address changes. Others require approval or followup action, like withdrawal forms. Most require audit trails or tracking throughout the processing of the form. And 13ers hate forms.

Think about the trail students follow to complete routine transactions like processing course withdrawal, pass/fail, and change of major. They journey from office to office to discover the source of the appropriate form, then it's off to obtain the required signature(s), and finally, if they haven't lost patience, they deliver the form for processing. Are all these steps necessary?

Withdrawal forms are often among the worst offenders, requiring signatures from a range of administrative offices. What the various offices need is the information that the student is leaving; they do not add value to the process by seeing the student.

Since their first visit to Disneyland, students have come to expect fast, pleasant, reliable service. Electronic data interchange (EDI) has revolutionized the process of sending and receiving transcripts, awarding transfer credit, certifying student attendance, and applying for admission. Now our internal business practices and information systems are being reengineered to provide new ways of presenting, transmitting and processing information.

At Boston College administrative offices have joined with Information Technology to offer one-stop service that automatically either completes a transaction or routes information throughout the university for simultaneous processing. Information is captured at the source, each field is edited when the data is entered, the form is transmitted to the recipient or approver who acts on it immediately, and notification can be transmitted back to the originator or to other parties on campus.

In May 1993 electronic forms were introduced to a broad base of users within the University when withdrawal transactions processed by the student's academic dean and the Office of Undergraduate Admission were transmitted electronically to other administrative offices. The result was more timely transmittal of information, faster processing of associated outcomes like refunds and housing changes, broader distribution of information to offices with a need to know, elimination of a redundant database of withdrawals, and of mailing and printing weekly withdrawal reports.

Other forms transmitted electronically include change of major, readmission, class lists and grade change acknowledgements to faculty, and credit memos.

Future Developments

The systems described above are only the beginning of what students will soon be able to accomplish. Statewide networks, links with feeder schools and Internet will allow students to tour the campus, estimate their financial need, search the catalog or library holdings, complete admission or financial aid applications, check the status of their applications, send a transcript, view a transfer course equivalency table, or obtain a credit evaluation and degree audit from their desktop.

Expert advising systems can be designed that will prepare a graduation path with optimum sequencing of courses. Courses that are offered biannually could be scheduled in advance, and students could relax knowing that courses leading toward graduation will be completed on schedule.

Universal messaging allows messages originated in one medium to be automatically translated into another so that users get their messages no matter how they access their mailboxes.

Chip card technology, which turns a student ID card into a computer, can be used to store and update information each time the card is used.

Conclusion

Are the days of personal service at an end? The 13th generation relies on the consistent, mechanized quality and service of *McDonald's* and *Pizza* Hut, the well-ordered, self-service of *The Gap*, and the remote, overnight service of *Land's End* and *L.L. Bean.* This coupled with their lifetime use of remote controls, telephones, VCRs, bank cards and computers makes them well disposed to controlling their environment and their choices. The human touch may not be as important to them as it was to previous generations.

The benefits to institutions that take advantage of the predisposition of these students by implementing do-it-yourself systems include reduced staffing needs and greater employee satisfaction. Staff who no longer process routine transactions or answer the same questions are freed to become more service-oriented, more technical and more knowledgeable. Systems must be reeningeered for staff as well as students so that they can easily access the information they need to resolve the more complex queries from students that they are unable to handle themselves. For example, the resolution of a registration question may involve the need to retrieve information about the student's financial aid and account.

The challenge for higher education the 1990s and beyond is to unleash the creativity of its students, instructors and administrators through new services and features made possible by information technology. It will be essential to rethink the essence of our business in order to improve the quantity, consistency and availability of the services that institutions of higher education provide. From inquiry to registration, from advisement through extracurricular life to graduation, the content and delivery of the collegiate experience is being redefined everyday. Reengineering for continuous improvement to serve the 13th generation is one way of envisioning an institutional response to this challenge.

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Growing the Customer-IS Partnership in System Development

Susan R. Griffith
Assistant Vice President for Planning and Administration

Mary E. Cauble
Assistant Manager, Information Systems and Services

Donald D. Volz
Manager, Information Systems and Services

Southwest Texas State University
San Marcos, Texas 78666

Abstract

The System Development Life Cycle (SDLC) process has been adopted at a major public university in the southwest to direct the development of automated and non-automated systems on campus. This paper discusses the problems and opportunities that spurred the consideration of SDLC, and the customer's involvement in the development of policies and procedures, and testing and improving the process, as well as the customer's critical role in implementing the process. The results of early projects and lessons learned are shared with the reader.

Introduction

It is now a generally accepted fact that the customer's role is vital to the success of any system development project. However, the customer's comprehension of what is involved in system development is often sketchy at best. Rare is the customer who understands the systems approach to solving problems - to first define the problem, to identify requirements of a solution, to explore the feasibility of alternatives, etc. For too long, information services organizations have sought, assumed, or been assigned too much responsibility for these activities. The lack of customer satisfaction with the results should not be a surprise to anyone.

Southwest Texas State University is implementing a Systems Development Life Cycle (SDLC) methodology that strives to address these issues. SDLC identifies tasks to be accomplished and outlines mutually interdependent responsibilities of customers and system designers during the development process. It provides customers an understanding of the work and participation expected of their units in obtaining a desired service or product. It is a single, uniform approach applied consistently to system development projects. The use of SDLC should result in a product which is right for its intended purpose, which meets customer expectations, and which is delivered on time and at a reasonable cost to the University.

This paper describes the problems and opportunities that provided impetus for action, the process used in developing the methodology, the policy and procedural documents that evolved, and the results and conclusions to date.

Background

The Institution

Founded as a Normal School in 1899, Southwest Texas State University has evolved into a comprehensive public institution with an enrollment of 21,000 students, the 7th largest institution in the state of Texas and the 8th largest in the United States without a doctorate. SWT is located in San Marcos, a rural area halfway between Austin and San Antonio.

Internally, SWT is governed by President's Cabinet, comprised of the President, the Executive Vice President, and the Vice Presidents of Academic Affairs, Finance and Support Services, Student Affairs, and University Advancement. The information services function at SWT is known as Computing Services and reports to the Executive Vice President. Computing Services (CS) is comprised of three (3) service areas: Computer and Network Support Services, Information Systems and Services (ISS), and Systems Software Services.

The Technology Infrastructure

Computing Services administers two (2) computer centers equipped primarily with Digital Equipment Corporation (DEC) hardware. The academic center houses a DEC VAX 8820 and a DEC ALPHA-AXP 7000-640. The administrative center is equipped with a DEC VAX 7000-630 and a DEC VAX 6000-620. The two (2) centers

form a mixed mode cluster, with OpenVMS 6.1 as the operating system. Several MicroVAX, ALPHA-AXP, and other servers and workstations are also housed in these centers. In addition, SWT has implemented a multi-protocol Campus Wide Network comprised of FDDI, extended 802.3 Ethernets, Novell and AppleTalk LANs. Students, faculty and staff utilize a diverse collection of over 2,500 microcomputers, most of which are connected to the Campus Wide Network. Another 500 VT series terminals are connected to the OpenVMS cluster in various ways.

Problems and Opportunities: Impetus for Action

Migration to VAXcluster

Between 1976 and 1989, the SWT ISS department had developed applications to address information processing needs in virtually every campus department. Applications ranged from the more typical financial, student, and human resource information systems, to police, housing, library, and physical plant systems. All of these applications were developed in-house on DECsystem-10's, and utilized a common, highly integrated, non-redundant database. With the imminent demise of the DEC-10 architecture, all administrative applications and the entire administrative computing environment had to be replaced.

In January 1989, a special Migration Steering Committee, with representation from each university division, was established to monitor the migration, enforce development restrictions, and establish priorities for allocation of scarce resources. Three (3) years later, SWT completed the migration of administrative computing applications from the DECsystem-10's to a VAXcluster platform. Administrative applications were replaced through in-house re-engineering, in-house conversion, or purchased software. Some of the purchased software required extensive customization.

The migration was successfully completed in three (3) years due in part to support from the administration. With help of the Migration Steering Committee, enhancements and new development were severely restricted, limited almost entirely to externally imposed mandates. To expedite the migration and support subsequent operations, the administration also funded additional positions in CS and customer departments. There was a down side to the development restrictions: by the end of the migration, pent-up customer demand was at an all-time high.

Ineffective Priority-Setting Processes

With all this pent-up demand, the issue of setting project priorities quickly became critical. Everyone recognized that SWT could not go back to the pre-migration method of prioritizing requests. Prior to the migration, ISS time had been allocated among the university divisions in fixed hour amounts. Each division had its own priority committee responsible for maintaining a wish list of "things to be done". There were no criteria for measuring the importance of a request, just some generally accepted guidelines like:

- o If it is Payroll, it must be important.
- o If it is Registration, it must be important.

- o If the Vice President said to do it, just do it.
- o If the Legislature wants it, do it first!

These priority committees met irregularly to determine what requests had been completed, why ISS had not completed more of the requests on the list, what new "top" priority items should be added to the list, and how many of the items were now a "number one" priority. With the exception of a few university initiatives, ISS decided which "number one" priorities would be addressed. In 1976, this method of prioritization actually worked well. Automated systems were few in number and relatively simple, therefore maintenance requirements were low and resources for new development were adequate. Over time, the number and complexity of systems increased while resources remained static. As a result, maintenance increased, development decreased and completion of requests became more and more infrequent.

Divisions began to jealously guard their time allocations and an informal process developed that benefitted privileged customers. The same customers always enjoyed the lion's share of the resources. No division was willing to dedicate any of its allocation to university-wide projects; however, they still expected these projects to be completed. No division was willing to allocate time for the changes necessary to keep current systems viable.

Inconsistent Level of Customer Satisfaction

Access to an official priority list or the informal "privileged" list was still no guarantee of customer satisfaction. Many requests for new development or system enhancements were verbal, often a result of a hallway conversation. While customers regarded these verbal requests as the end of their responsibility, ISS expected (and waited for) a little more detail. Whenever these requests fell through the cracks the result was frustration for everyone.

Even when a project did get off the ground, customer satisfaction was often low because the accepted methodology for system development did not include customers. Responsibility for all phases of system development rested primarily with ISS. At best, when partnerships were strong and responsibilities were shared between ISS and the customer, good system design practices and a successful project with a satisfied customer resulted. At worst, the customer abdicated responsibility for system functionality and workflow, projects were not successful and the customer was not satisfied. There was definitely a pattern: customer satisfaction was directly proportional to the extent of customer involvement in the process.

Inadequate Customer Training and Process Documentation

Many customers assumed that if a procedure was automated, then ISS was responsible for both workflow documentation and all training. While ISS provided procedures for operating the software, these procedures were rarely included in any overall office workflow documentation, because no such document existed. By default the procedures for operating the software became the office workflow documentation. The software began to dictate office procedure, customers effectively lost control of their office operations, and the ISS analyst responsible for that application became the expert in customer office operation.

While it was generally understood that ISS provide initial training on newly implemented systems, customers expected that ISS continue to provide training whenever necessary. This expectation and the lack of workflow documentation meant that current office staff were not prepared to train new employees without ISS assistance.

ISS was frustrated; they did not have the resources to provide offices with procedure manuals and training for all new employees. Customer managers were frustrated, realizing that they had become too dependent upon ISS.

Internal Mandates

Internal mandates were another problem. "Internal mandates" have implementation deadlines set without adequate data, planning, or forethought. They commit the institution to action without regard to the impact upon stakeholders, projects already underway, and resource commitments already made. A project name and a due date is all there is.

A typical scenario might be as follows: The President, Provost, or Registrar promises delivery of a long anticipated Telephone Registration system within a year. Trouble is, the Information Systems Manager and the Telephone Services Manager find out about the "commitment" and the associated implementation calendar in the campus newspaper. Every person on campus has a different definition and expectation of telephone registration, but they all share the same date of delivery.

Islands, Orphans, and Cannons

SWT is like many campuses in that departments enjoy considerable autonomy with investments in technology. Even the most up-to-date and clearly articulated standards will be ignored in the face of gifts-in-kind and grant requirements. FREE = GOOD, right? Just as night follows day, the result has been the inevitable "Islands of Technology" where hardware and software incompatibilities abound. But not to worry, "The experts in CS can make everything work together, or else they must not be very good."

Orphan systems are another common problem -- outsourcing at its worst. A department hires a consultant (translation, Computer Science graduate student) to develop an application they need because ISS is too backlogged. The application is written using obscure languages or tools that the graduate student wanted to learn, but which were otherwise new to the campus. The graduate student documents nothing and cares little about maintainability. Eventually he/she graduates and leaves for parts unknown with the source code. But not to worry, "The experts in ISS can fix it and support it in the future, or else they must not be very good."

And let's not forget "loose cannons", the self-appointed experts who know how to do everything they've never done. They can be easily recognized by the way they begin their sentences: "All CS has to do is ..." or "Why can't CS just ..." or "At Utopia U., we did it this way ..." are favorites. But not to worry, if it's been done anywhere else, then "The experts in CS and ISS can and should make it happen here, or else they must not be very good."

Internal Audit Findings

An Internal Audit finding in February 1991 was critical of SWT's system development methodology. The major issues were that customer involvement was minimal, customer requirements were not documented, cost management was nonexistent, and project schedules had no credibility. The Auditor recommended that the University adopt a formal system development methodology.

All these problems led to the inescapable conclusion that SWT needed something significantly better.

Developing the SDLC Methodology

Forming the SDLC Team

To begin addressing the problems identified, the System Development Life Cycle (SDLC) Team was appointed by the President in June 1991. The Team was comprised of at least one member from each of the five (5) divisions at the University, two (2) members of CS, and a representative of Internal Audit ex officio. Faculty, staff, and administrative constituencies were represented. The Team was charged with drafting a policy and procedure document that outlined mutually interdependent responsibilities of customers and systems designers during the system development process, and offering an appeals process for conflict resolution.

Adopting a Philosophy

The first action of the SDLC Team was to develop a philosophy to guide its work. That philosophy emphasized partnership between customers and ISS. It stressed communication between stakeholders and designers of the system to insure the development of a product which was right for its intended purpose, and which was delivered on time and at a reasonable cost to the University.

Adapting a Model

The Team began with a model, "Understanding the Systems Development Process" (Long, 1983), that defined system development as a five (5) phase process. In addition, the Team referred to the IEEE software requirements specifications prototype outline (IEEE, 1984), Boehm's book Software Engineering Economics (1981), several articles from the CAUSE exchange library, etc.

One of the early challenges was taking a model developed for the corporate world and adapting it to higher education in general and SWT in particular. Some of the differences include: the motive of the institution is not profit, but expansion of services within existing resources; ISS can't politically refuse to work on a project; customers are not accustomed to budgeting for technology. To the Team, the most important elements to be added to the model were well-defined deliverables and responsibilities for those deliverables. With these things in mind and guided by their philosophy, the SDLC team adapted its model to the SWT culture.

Expanding the Team's Charge

The SDLC model was documented in the form of a university policy/procedure statement. The initial optimistic deadline for a draft document was five (5) months after the SDLC Team was formed, but it was not that easy. In that time, the Team developed their first draft, but circulating it to several customer groups and incorporating their feedback added eight (8) additional months before the revised draft was delivered to the President.

In addition to delivering the policy and procedure document, the Team recognized the need for some companion activities to insure success. These included:

- o Completion of a resource impact study.
- o Completion of a pilot study.
- o Identification of SDLC's impact on current policies and organization.
- o Education of the university community to the process, and gathering feedback from potential stakeholder groups to improve the process.
- o Development of a separate, detailed procedure manual to allow more flexibility in the policy statement.

While the charge to the SDLC Team was initially limited to the drafting of a policy and procedure statement, they knew that successful implementation of SDLC would require that upper management address certain issues. The Team recommended to President's Cabinet. First, the membership and structure of priority setting committees had to be strengthened. Second, an oversight body with a university-wide perspective on resource allocation had to be established. Third, President's Cabinet had to be dissuaded from establishing "internal mandates" without regard to resource availability. Fourth, improved communication and tracking mechanisms had to be developed.

The Team was given authority to present the draft policy and procedure to various groups of customers across campus. True to a commitment to customer involvement, over a period of two (2) months, members visited all the division councils, academic support and school councils, plus Faculty Senate, Staff Council, Computing Services, and the area functional analysts. With the comments received from these groups and the results of the first phase of the pilot study, the Team revised the SDLC policy and procedure document, which was officially disseminated in July 1993, two (2) years after the Team was appointed. The Team's charge was expanded to include oversight of the pilot study, development of training curricula, development of the procedure manual, and review of the process's impact on other SWT policies and organizational structures.

The SDLC Document

The purpose of the SDLC document is threefold: to define the six (6) phases that all SWT system development projects will follow, to identify and assign the attendant tasks and responsibilities, and to specify the responsibilities of the oversight body, the System Development Council. The document also directs the reader to the procedure manual for greater detail. The six (6) SDLC phases, familiar to IS professionals but not to their customers, include:

Phase I - System Initiation and Feasibility Study
Phase II - System Analysis

Phase III - System Design
Phase IV - Programming
Phase V - Conversion and Implementation
Phase VI - Post-Implementation Evaluation

Perhaps the greatest aspect of the SDLC document is the delineation of responsibilities to five (5) major groups of players: customers, feasibility study and project teams, area functional analysts (AFA), ISS, and upper management. These groups and the responsibility assignments are described here.

Customers. The SDLC process is designed to return control to customers and stakeholders by requiring their involvement. They are assigned responsibility for documenting the current system, documenting requirements of the new system, examining alternatives, providing human resources, monitoring progress, reviewing formal requirements and system design, testing and formally accepting the system, completing procedure documentation, and monitoring the system for enhancements and corrections. This drastic increase in the level of customer involvement is the greatest change to prior practice and the greatest risk to success: SDLC will fail if it does not demonstrate that the quality benefits justify the intensive customer time commitment.

Feasibility Study and Project Teams. Customers are the primary members of both the feasibility study team and the project team, and it is strongly suggested that a customer lead both these teams. These leaders do not need computing expertise. They need to be good at time management, people management, detail work, task coordination and project tracking, and most importantly they need to be champions of the projects. Other members of these teams include ISS and CS representatives, AFA's and other stakeholders identified.

Area Functional Analysts. While a customer is or should be the team leader, a great deal of responsibility falls on the "Area Functional Analyst" (AFA). This position was created during the VAX migration to act as a liaison between customers and Computing Services. The AFA reports to the customer's department or division, which gives the customer control over more resources specifically dedicated to system development. The AFA assists the customer in preparation, submission, and communication of service requests and plays a leading role on the feasibility study team. The AFA also participates heavily on the project team in detail requirements definition, design review, acceptance testing, and training of customers.

ISS. ISS now concentrates on screening and categorizing service requests, and in the system design, integration, and programming phases. Basically, the responsibility for project initiation, feasibility study, functional analysis, product implementation, and post-implementation evaluation shifted from ISS staff to the customer.

Upper Management. Upper management's responsibilities include understanding and judging the relative value of projects, committing the resources at their disposal, monitoring progress, and providing timely policy decisions which affect the process itself.

Developing the SDLC Procedure Manual

As a result of the feedback received from the community, the policy and procedure document was condensed. It became apparent that the process was complicated enough to warrant an operational manual to help people implement all six (6) phases of the SDLC process.

In the manual, each of the six (6) phases of the process is detailed in operational steps. Each step includes a brief narrative of the associated procedure, identification of the parties responsible for and involved in that step, and the deliverable outcomes expected. Due to the rather "laissez faire" attitude of customers prior to the SDLC process, the Team was very concerned about clarifying responsibilities so that ownership of the process indeed rested with the customer. In addition to narratives, flow charts of each phase and examples of deliverables are included in the manual to support those customers for whom "a picture is worth a thousand words".

The customers have had the manual for SDLC Phases I and II since December 1993. In Summer 1994, feedback from customers was incorporated and revisions were distributed. The first draft for Phases III-VI is currently in the hands of several readers, whose feedback will be incorporated in the version distributed in December 1994.

New ISS Policies and Procedures

Early on, the SDLC Team recognized that ISS policies and procedures were poorly communicated and generally misunderstood. Customers simply did not know how ISS resources were allocated or how to get ISS resources focused on their needs. The migration had imposed restrictions, structures and processes that were no longer needed, and the pre-migration methodology had been happily forgotten by all. Customers needed new structures and processes to fill the void, to help ISS serve them.

To address that need, and to act as a companion with the SDLC policy and procedure statement, ISS drafted a document entitled "Obtaining Administrative Information Systems and Services". In this policy/ procedure statement, ISS provided a detailed explanation of:

- how ISS staff resources are allocated,
- how ISS services are requested, and
- how projects are initiated and their scope is assessed.

ISS Resource Allocations. ISS staff resources are allocated in two (2) ways: by activity type and by activity area. The policy statement defines five (5) activity types and establishes annual targets for the percentage of total ISS staff hours to be invested in each activity type. These types are burden (30%), maintenance (20%), enhancement (20%), development (20%) and research (10%). Articulating these targets has given the customers a more realistic perspective of what ISS does, and how ISS spends its time.

The second method of allocation is by activity area. This method identifies the ISS FTE's devoted to specific applications and services. It provides customers with an idea of how ISS resources are spread across the customer base. It tells them how many ISS staff are involved in the support of general database administration, student records applications, human resource applications, internal ISS training, etc.

By publishing the ISS resource allocations by both activity type and by activity area, ISS has eliminated some of the "secrecy" and customer suspicion about ISS activities. Customers now have an increased understanding of the ISS resources available, where and how they are invested, and the need for customer prioritization of requests.

The ISS Service Request. Past audit findings were critical of the fact that significant modifications were often made to applications without written authorization, and the modifications were often made without input from others who might be impacted by the change. ISS also found that customers were dissatisfied because applications sometimes treated symptoms without solving the root problem, and/or did not meet the customers' expectations.

To address these issues, the ISS policy statement defines a process for requesting services that focuses on problem and/or opportunity definition and communication of the request to all stakeholders. The policy specifies that service requests include a title, a goal statement and supporting objectives (by which satisfaction of the request will be measured), a description of the problem or opportunity to be addressed, and a list of known stakeholders. Implementation methods and solutions are specifically EXCLUDED from the problem/opportunity description, and the request must be published to solicit feedback from stakeholders.

Area functional analysts and ISS staff readily and regularly assist customers in completing service requests to assure that the problem is stated, not just a solution. In addition, helping customers with requests provides an early idea of the scope of the request and sometimes even eliminates the request if the solution already exists.

Assessing the Scope of the Request. A well-written request and feedback from stakeholders provides the information necessary for the customer, the area functional analyst, and the ISS analyst to determine the size, complexity and general scope of the project. This information allows them to get general answers to questions like:

- Is this an enhancement, development, or research activity?
- How might other customers and applications be impacted?
- What needs and opportunities exist for integration?
- What are the major constraints?
- What customer resources are available to satisfy the request?
- Are current hardware/software/network capacities adequate?
- To what depth should alternative approaches be pursued?

And most importantly,

- What SDLC activities and prioritization level(s) are appropriate for this request?

Responding to Recommendations of the SDLC Team

The SDLC Team recommended to upper management several policy, procedure, and structural changes to assure that SDLC worked well. The Team submitted recommendations related to priority setting, an oversight body, mandates, and improved communication and tracking mechanisms.

Improving Customer Prioritization and Commitment of Resources

SWT is no exception to the shrinking of financial resources afforded to higher education. SWT's student:faculty ratio is 20:1 and its student:staff ratio is 17.5:1, so human resources are extremely limited as well. One of SDLC's goals is to apply these resources where they provide the greatest return on investment in pursuit of the strategic plans of departments, divisions, and the University as a whole. To do this, customers must decide where to invest, not only their own resources, but ISS

resources as well. They must actively participate in leveraging these investments to provide the greatest benefit at the least cost to the University.

Priority-setting bodies at SWT have improved. They are following the letter and the spirit of SDLC, and are consciously making priority decisions. ISS is no longer in the position of having to choose from among dozens of top priorities.

Under SDLC, the appropriate level (department, division, and university) of prioritization is determined by the size, scope and complexity of the project.

Department. Departmental prioritization is all that is necessary if the customer or requestor, ISS, and the stakeholders all agree that the scope of the request is limited enough to address it at that level. Generally, this means that the request can be satisfied using resources that are readily available to the customer, and with little or no impact upon other departments. A department must set the initial priority of each request it originates relative to its other pending requests.

Division. If the customer/requestor, ISS, or a majority of stakeholders believes that the request is large enough, complex enough, or has significant impact outside of the requesting department, then divisional prioritization is required. Requests receive divisional prioritization via whatever mechanism is established by the division vice president; this mechanism is usually a division priority committee.

University. If a request requires commitment of resources normally allocated to offices outside of the requesting division, or has a high risk and/or visibility, or is considered of strategic importance to the University, it must obtain a university-level priority. University-level priorities are established by the System Development Council.

Addressing Mandates

An issue related to priority-setting which was improved by the SDLC process was the handling of mandates, both internal and external. Internal mandates were set by President's Cabinet (PC); external mandates came from state and federal agencies.

Internal Mandates. Perhaps the most sensitive recommendation of the SDLC Team dealt with PC's habit of endorsing project implementation dates without regard to the impact of that decision on available resources and current project calendars. PC readily agreed to restrict its endorsements to support for ideas, and to rely on the feasibility study to identify method, resources, and timeline.

External Mandates. Prior to the establishment of SDLC, customers tended to abdicate much of their responsibility for defining how state and federal mandates would be addressed. Whenever such a mandate was received, the memorandum from the mandating agency was simply forwarded to ISS, along with a directive to "make sure we can comply with this." It was not at all uncommon for ISS staff to be working directly with personnel from the mandating agency, rather than from specifications provided by university staff. SDLC has changed all that. External mandates are now handled in the same way as any other request. A service request that defines the problem, goals and objectives is submitted and must be prioritized like any other request. This change has had many positive results. Customers are aware of the impact of external mandates on other projects and scarce university resources. They are more involved in determining the scope of the mandated project and methods for compliance, and have begun to see the opportunities in external mandates. Where before, SWT might derive no direct benefit from complying with an external mandate, customers now take the opportunity to address local needs at the same time.

Establishing an Oversight Body

The administration endorsed the establishment of an oversight body for the SDLC process. This body, the System Development Council, oversees system development, prioritizes and tracks university-wide projects, makes policy and procedure revisions necessary as the SDLC process evolves, resolves conflict among divisions, and sponsors the development of SDLC training resources. This Council is chaired by the Executive Vice President, and includes one representative from each division, as well as two ex officio members, the Director of Computing Services and a representative of the Academic Computing Committee. The divisional representatives lead their divisions' priority-setting bodies and have the knowledge and authority to commit divisional resources to projects.

Improving Communication and Tracking Systems

As one might expect, involving an expanding number of customers created additional communication problems. Priority committees and project teams needed a better way to communicate service requests and track the status of projects. To meet this need, an electronic conference is being pilot tested. The conference serves as a repository for service requests, feasibility study results, and other SDLC deliverables. As projects move through the six (6) phases of SDLC, those with access to the conference will be able to follow the progress of the projects and comment on developments. The conference opens up the process and indirectly increases the accountability of those involved.

Initial Project Experiences

Below are snapshots of a few early projects which have used the SDLC methodology. These experiences helped reinforce the belief that imposing structure on the decision-making process (SDLC) would result in a product which better satisfies the customer.

Pilot Project

SWT's pilot project was the emergency tuition loan program management system. The members of the feasibility study and project teams were initially resentful of the amount of time they had to invest in the project by following SDLC guidelines. However, when the project was complete they acknowledged that they had a better product than they would have had using previous methods. They were forced to talk across departments and divisions and solved problems that previously would not have been discovered until much later.

Student Health Center

To paraphrase a Health Center staff member, "I thought SDLC was only a bureaucratic hoop. But after two (2) previous attempts at automating our system, the feasibility study experience forced us to define and document the different but related

needs of doctors, nurses, receptionists, pharmacists, and others on the Health Center staff. And for the first time we had a comprehensive document to use in evaluating solutions."

Budget Development

The SDLC process has helped to control some rogues who would advance hidden agendas at the expense of solving the problem. Feasibility study team members used the SDLC process to maintain focus on the problem and kept the University from making an expensive mistake.

Payroll

The feasibility study team for the electronic payroll deposit project involved university employees in the design of a new earnings statement. SDLC helped the Payroll Office recognize that they are not the user of the earnings statement. For the first time employees had an opportunity to define what information they needed from their payroll system.

Changes in Attitude

Several major changes in attitude and expectations have been among the most important outcomes of the SDLC process. First, there is broader campus understanding that customer satisfaction (quality) is directly proportional to:

- The level of customer involvement.
- Communication of stakeholder and customer expectations.
- The mix (Stakeholder types) of involved customers.
- The leadership of one or more customers as "Champions".

Second, the implementation of any campus-wide methodology of this magnitude is a long-term commitment of resources. As a result:

- SDLC policies and procedures are recognized as continually evolving.
- Attention to customer support needs are addressed through continuous investment in the procedures manual and training activities.
- Priority committees have increased in number, size and representation and are becoming leaders in making SDLC work.

Conclusions: Some Rules for Success

"CUSTOMER FOCUS", "SATISFYING THE CUSTOMER", "EMPOWERING THE USER". These are some of the buzz phrases of the '90's, especially within TQM. These are worthy goals, but they can only be accomplished in systems development when management grants and the customer accepts responsibility as a full partner. SDLC is not a perfect solution. Neither was MBO, nor is TQM. It is up to the people to make any of these work.

As a result of the SDLC experience, SWT has accepted certain truths as basic to the understanding and operation of the process. Reviewing the following "pearls of

wisdom" before developing a similar SDLC process may help others save time, organize debate, and limit unrealistic expectations:

- o SDLC does not create new resources; it just uses them more effectively and more efficiently.
- o Prioritization is often a determination of what won't get done.
- o Some worthwhile projects will never get done; customers will still hear "no", but now it will be "no, because ...".
- o Customers will have to spend more time planning and managing projects.
- o Priority committees, and especially their chairs, are critical to making the process work, and these individuals will develop necessary expertise at different rates.
- o It will take time and training to turn customers into project managers.
- o Estimates will be awful at first but will improve with experience.
- o Focus on the "WHAT", i.e., delineate WHAT deliverables are needed.
- o Focus on the "WHO", i.e., delineate roles to be filled - WHO does WHAT
- o Allow flexibility with the "HOW", i.e., formats and methods.

At SWT, the SDLC process in its early implementation has proven successful due to the involvement of the customer, the reliance on a tested decision-making process, the development of simplified procedures for guidance, and a degree of flexibility in choosing from among the suggested SDLC steps and the ordering of those steps. In addition, the institution is better able to establish realistic expectations for project development within limited resources. At SWT, it looks like SDLC is working.

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